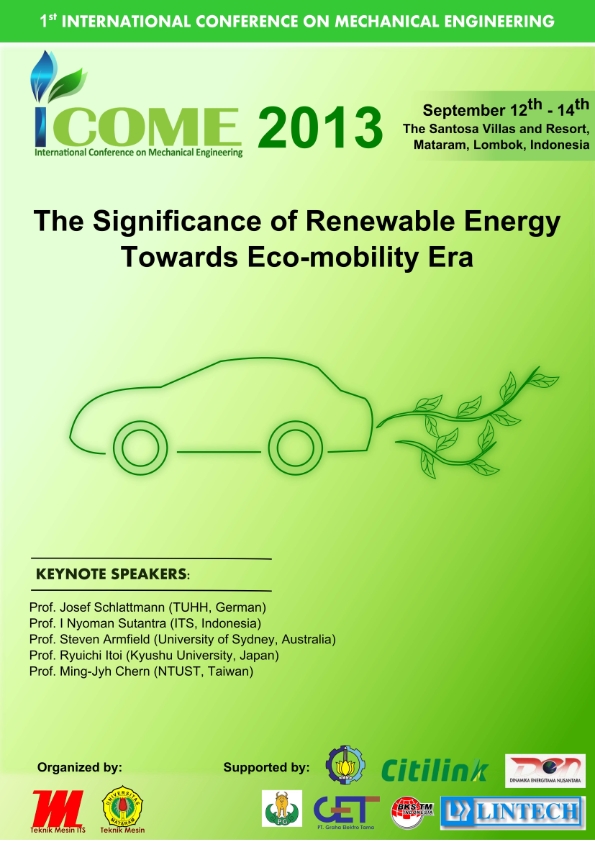
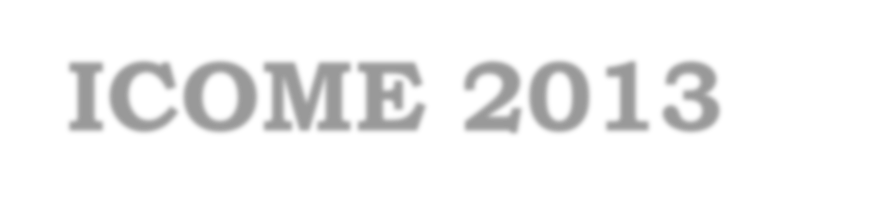
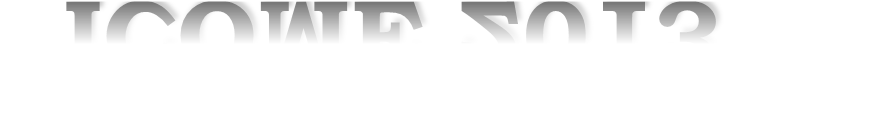
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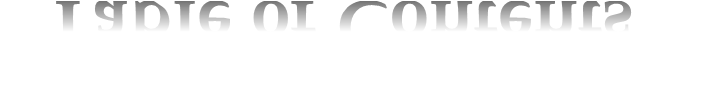
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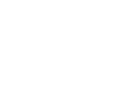
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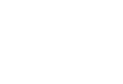
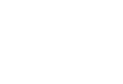
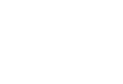
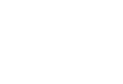
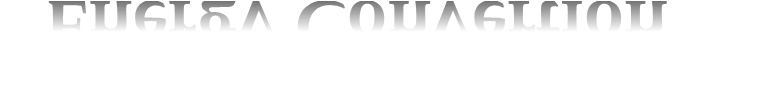
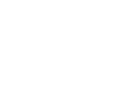
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**Energy Convertion**

**An investigation into the effect of Drag coefficient on overtaking of Car**

Dani Harmanto and Salah Al Homoud *University of Derby, United Kingdom* [d.harmanto@derby.ac.uk](mailto:harmanto@derby.ac.uk)

**Abstract**― The purpose of this report is the effect of the drag coefficient on the car when it is travelling on the road and at different positions while overtaking. The investigation uses Solid Works Flow simulation software to conduct CFD. A car and truck has been designed in actual dimensions using Solid Works. After performing the validation of the software, the simulation is performed having the car in four different positions. The results will determine the drag coefficient and how it is affected in the different positions.

**Keywords:** CFD; Cars overtaking; Drag coefficient; simulation; truck; Solid Works; aerodynamics

**Laminar Flow Visualization Pattern on Sharp Edge Bifurcation T-Junction**

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**Abstract**―In the previous study, sharp edge T-junction had been investigated to determine head losses and flow pattern. In this study, sharp edge bifurcation T-junction was used as inlet flow model scale to determine laminar flow visualization pattern. The apparatus test provide a flow channel on static conditions which is the inlet pressure larger than 1 atm. Pressure difference is measured by a U-pipe manometer. The manometer was inserted between inlet and outlet. Flow rate is measured by collecting fluid into a measuring cup. Laminar flow visualization pattern is one of solution to perform the mechanism of sharp edge bifurcation T-junction as inlet flow model scale. The result shows that flow pattern from simulation has the same trend with experimental results.

**Keywords:** *T-junction; flow visualization; sharp edge; laminar flow*

**Laminar flow past a circular cylinder : Reduction of drag and fluctuating lift using upstream and downstream rods**

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**Abstract**― Laminar flow past a circular cylinder has been studied numerically at low Reynolds number. The upstream and downstream rods have been used as passive control in order to reduce hydrodynamics forces acting on the cylinder. Both the upstream and downstream rods significantly contribute in reduction of drag and fluctuating lift compared to single cylinder without the rods. More detail, the upstream installation rod is more dominant in drag reduction than the downstream one. On the contrary, the downstream rod has suppressed the magnitude of the fluctuating lift almost twice that of the upstream configuration. Placing the two rods together as the upstream and downstream passive control in tandem arrangement has given more hydrodynamics forces reduction than the single rod configurations.

**Keywords:** *Circular cylinder; passive control; tandem; drag; lift*

**CFD Study in the Use of Through Body Ducting to Provide Aerodynamic Downforce and Reduce Drag**

Dani Harmanto and Richard Milner *University of Derby,United Kingdom* [d.harmanto@derby.ac.uk](mailto:harmanto@derby.ac.uk)

**Abstract**― The implementation and use of through-body ducting in a production car in order to produce ground effect aerodynamics is investigated and compared to the more standard use of rear wings. Modelling software is used to create the vehicle and design the system with flow simulation software used to analyse the system in terms of lift and drag. Consideration is given on how to improve the design with recommendations stated.

***Keywords:*** *CFD; Computational Fluid Dynamics; Aerodynamics; Race Car Ducting; Downforce; Coefficient; Drag; Air Flow; Wing; Subaru; CAD Model; Simulation; Mesh*

**Reynolds number - Strouhal number relationship for cylindrical bluff body with variation of aspect ratio in high Reynolds number**

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**Abstract**― The effect between Reynolds number and bluff body aspect ratio to the flow parameters such as

Strouhal number and drag coefficient are studied. The range of Reynolds number applied is within 10000 and

200000 while three aspect ratio(Ar) where Ar = 1.0, 1.5 and 2.0 are implemented. Finite volume method with the aid of ANSYS CFX codes is deployed using the turbulence SST model. Equations of Re-St relationship for Ar 1.0

and 1.5 are then hypothesized as well in this paper for the range of 10000<Re<100000.

***Keywords:*** *Bluff bodies; Reynolds number; Strouhal number; drag coefficient; aspect ratio; ANSYS CFX codes*

**An experimental study on the vertical flow past a finite-length horizontal cylinder**

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**Abstract**― The research studies the characteristics of the vertical flow past a finite-length horizontal cylinder with Reynolds numbers (ReD) from 250 to 1080. The experiments were performed in a vertical closed-loop water tunnel. Flow fields were observed by the particle tracer approach for flow visualization and measured by the Particle Image Velocimetry (P.I.V.) approach for velocity fields. The interaction between the downwash flow and Von Kármán vortex street in the wake of the cylinder is presented in this paper. The characteristics of vortex formation in the wake of the finite-length cylinder change at different regions from its free end. Near the free end, a pair of vortices in the wake was observed and the size of the vortex pair increased as the observed section away from the free end. Around a distance of 3 times the size of the cylinder diameter (X/D = -3) from its free end, the vortex street started to take place in the wake for some Reynolds numbers. At X/D = -3, a pair of vortices was observed in the wake for ReD = 250, but when ReD increased to 560 and the higher values the vortex street was observed at the same location. Experimental results show that the downwash flow affects the vortex shedding frequency even to X/D = -5. The downwash effect decreases with the distance away from the free end of the finite cylinder and vanishes at X/D = -10.

***Keywords:*** *Particle tracer flow visualization; Particle Image Velocimetry (P.I.V.); Vortex shedding frequency; Fast Fourier Transform (FFT); Downwash effect*

**An Investigation into the Aerodynamic Efficiency of a Vintage Light Aircraft Wheel**

**Fairings using SolidWorks**

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**Abstract**― The purpose of this paper is to investigate the aerodynamic efficiency of the wheel fairings of a light aircraft. This investigation will use SolidWorks Flow simulation software. A full size model of the aircraft wheel fairings will be created using 3D modelling techniques. The aerodynamic efficiency of the fairings will be determined and a comparison made with modern designs to determine if efficiency improvements can be possible.

***Keywords:*** *Efficiency Aircraft Fuel; CFD; SolidWorks; Drag*

**Reduction of Drag Force on a Circular Cylinder and Pressure Drop Using a Square**

**Cylinder as Disturbance Body in a Narrow Channel**

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**Abstract**― Many studies related with characteristics of fluid flow around a bluff body have been conducted. The aim of this research paper was to reduce pressure drop occurs in a small duct, in which there was a circular cylindrical configuration with an inlet disturbance body shaped of square cylinder was founded. Another goal of this research was to reduce the drag force occurs in circular cylinder. Experimentally research of flow characteristics of the narrow channel had a square cross-section with implemented of Reynolds number based on the hydraulic diameter from 5.21 x 104 to 1.56 x 105. Wind tunnel that was used had a 125x125mm cross-sectional area and the blockage ratio 26.4% and 36.4%. Specimen was in the form of circular cylinder and square inlet disturbance. Variation of angle position was the inlet disturbance body with α = 200, 300, 400, 500 and 600, respectively. The results was obtained from this study was Reynolds Number value was directly linear with pressure drop there, it was marked by increasing of Reynolds number, the value was also increasing pressure drop. Additional information was obtained by adding inlet disturbance body shaped of square inlet disturbance body on the upstream side of the circular cylinder that could reduce pressure drop in the duct and reduce drag happening on a circular cylinder. The position of the optimum angle to reduce pressure drop and drag force was found on the inlet disturbance body with angle α = 300.

***Keywords:*** *Square cylinder; Pressure drop; narrow channel; Drag force*

**CFD Simulation of Heat Transfer in Fluidized Bed Reactor**

I Nyoman Suprapta Winaya, I Made Agus Putrawan, I Nyoman Gede Sujana and Made Sucipta *Mechanical Engineering Department, Udayana University, Bali, Indonesia* in[s.winaya@me.unud.ac.id](mailto:winaya@me.unud.ac.id)

**Abstract**― This study aims to predict heat transfer from a heated bed in a gas fluidized bed using Syamlal- O’Brien drag coefficient. Discrete particles model with the Navier-Stokes equation and Eulerian multiphase are used to approach heat transfer simulation. Coefficient of heat transfer which is related to Nusselt Number and volume fraction are calculated using Egun model which was compiled from C++ program language. The effect of fludization velocity variation on the heat transfer coefficient comes to the fore, indicating the heat transfer and solid volume fraction at the bed height are very dependent. Contour of solid volume fraction and temperature distribution are also presented.

**Keywords:** *CFD; heat transfer; fluidized bed; Syamlal-O’Brein; drag coefficient; Eulerian*

**An Iso-octane fed Proton-conducting SOFC Hybrid System**

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**Abstract**―We investigate a thermodynamic model of a hybrid system consisting of a proton-conducting solid oxide fuel cell (pSOFC), a micro gas turbine (MGT) and a steam reformer fueled by iso-octane. Commercial software, thermolib 5.1 from EUtech was employed in this work. The effects of compressor pressure, fuel utilization, steam-to-carbon (S/C) ratio and bypass ratio on hydrogen production, TIT, power output and efficiency are investigated. The results show that increased compressor pressure has negative effect on the pSOFC power output but the overall system efficiency enhances. With the increase of the fuel utilization, the pSOFC power output increases but MGT power output reduces. However, overall system efficiency increases with increasing fuel utilization. Finally, the S/C and bypass ratio must be correctly chosen to maximize the efficiency of pSOFC- MGT hybrid system.

**Keywords:** *proton-conducting SOFC; Thermolib; SOFC-MGT; hybrid system*

**Energy and Exergy Analyses in Combined Microwave and Vacuum Drying Process of Porous Packed Bed**

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**Abstract**―This paper is concerned with the energy and exergy analyses combined microwave and vacuum drying process of porous packed bed were investigated. Drying experiments were conducted to find the effects of porous particle size and thermodynamics conditions on energy and exergy profiles. An energy analyses was performed to estimate the energy utilization by applying the first law of thermodynamics. An exergy analyses was performed to determine the exergy inlet, exergy outlet, exergy losses during the drying process by applying the second law of thermodynamics. The results show that energy utilization ratio (EUR) and exergy efficiency depend on the particle size as well as hydrodynamic properties, considering the interference between capillary flow and vapor diffusion in the porous packed bed.

**Keywords:** *Microwave vacuum drying; Energy utilization ratio; Exergy flow; Porous packed bed*

**Determination of the Optimum Operating Condition for Electricity Production**

**Optimization in Geothermal Power Plant Based on Thermodynamic Analysis**

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**Abstract**― Process of electrical power production in GPP depends heavily on energy conversion processes that occur within it. The process involves multiple variables operating conditions that have to be maintained at a certain value for a certain condition of geothermal production wells. This paper is preliminary study which proposes a method of determining the operating conditions of electrical power production in a GPP in order to obtain the maximum power of the process. Based on the case studies, it is concluded that the selecting of the process variable conditions depends on the dryness of geofluid. For the geofluid high enthalpy cases, the optimum separator temperature is close to the upper limit of separator temperature due to exhaust gas turbine constraint and the optimum condenser temperature is the one that at which the net power output is maximized. While for the geofluid low enthalpy cases, there is a peak point as an optimum condition that maximizes the objective function.

**Keywords:** *Optimization; geothermal power plant (GPP); thermodynamic*

**Design of a Bubbling Fluidized Bed Gasifier for the thermochemical conversion of**

**Oil Palm Empty Fruit Bunch Briquette.**

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**Abstract**― This paper is focused on the design of a bubbling fluidized bed gasifier (BFBG) for EFB briquette gasification. The annual production of palm oil in Malaysia generates large quantities of lignocellulosic biomass which can be converted into clean, sustainable energy for the future. Hence, the prospect of valorizing palm waste using biomass gasifiers presents a viable option for energy production. The fluidized bed gasifier (FBG) is considered the most suitable reactor for biomass gasification due excellent mixing, efficient heat temperature control and tolerance for fuels. Consequently, the proposed design of the bubbling fluidized bed gasifier for EFB briquette gasification will consist of three main parts; feeding zone, gasification zone and the effluent gas zone for syngas production. The results of feedstock physicochemical properties such as bulk density, particle size, the bed hydrodynamic and fluidization parameters for gasification used in the design of the gasifier are presented in this paper.

**Keywords:** *Bubbling Fluidized Bed Reactor; Gasification; Combustion; Oil Palm; Empty Fruit Bunch; Briquette*.

**Development of Biomass and Clean Coal Technologies in NCU**

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**Abstract**― Biomass is one important renewable energy resources of the world. Biomass is neutral of CO2 and has low pollutant emission. Therefore, the development of biomass energy technology has received a lot of attention worldwide in recent years. Besides, coal is one of the largest resources for power generation. How to efficiently use coal in a clean process is also one key issue for energy research. This paper reports the development of fast pyrolysis and gasification of biomass, and clean-coal research in NCU. Dust and fine particulate exist in the products after the process of fast pyrolysis and gasification of biomass or coal and make the bio-oil and syngas not used directly. Hence, a promising hot gas/vapor filter is a key component to develop the commercial scale of fast pyrolysis and gasification of biomass/coal. Moving granular bed filter is one of the promising technologies to clean the hot gas/vapor after the process of fast pyrolysis and gasification of biomass/coal. Moving granular bed filter has been investigated for many years in NCU and has been successfully tested and has high filtration efficiency (above 99.8%). It could be applied to the clean hot gas/vapor of gasification and fast pyrolysis of biomass.

**Keywords:** *Biomass;Clean coal; Gasification; Pyrolysis; Hot gas cleanup; Moving granular bed*

**Kamojang Geothermal Power Plant Unit-1 : 30 years of Operation**

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**Abstract**― UNIT-1 KAMOJANG geothermal power plant marked the new era of renewable energy in Indonesia. With its built capacity of 30 MWe, it constantly supply electricity to Java-Bali grid for more than 30 years now. Over those period, Unit-1 has given its best performance with highest achievement on Capacity Factor (CF) and Equivalent Availability Factor (EAF).

High performance geothermal power plant involves the integration not only from the point of view of power generation, but also the optimation of geothermal potention in the area. Kamojang geothermal field, which is considered as one among five steam dominated reservoir in the world produces 200 MWe of the electricity

nowadays. In order to maintain this production rate, some technical consideration must be made. Towards sustainable power generation of geothermal power, some assessment has been made to turbine, generator and cooling tower to ensure its current condition. Basically what it called remaining life assessment

gives a rough picture of how long the equipment will run through in its operational condition. Based on those assessment, additional 20.900 hours is given to the turbine with the existing operating conditions. On the other hand, cooling tower infrastucture test and simulation delivers operation period for another 25 years.

**Keywords:** *Geothermal; power plant; remaining life assesment*

**Gaining the Enthalpy of Solid Yields Formation in the Process of Waste Pyrolysis**

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**Abstract**― An experimental study of pyrolysis method had been conducted to support the waste-to-energy program. It was very attractive method to convert the waste; cow dung and municipal solid waste in short time, only 2 hours. An appropriate pyrolyzer is required to support this process from the heat transfer mechanism and consider the chemical reaction. Therefore, the study aims to analyze the influence of different temperatures on the measured enthalpy of waste pyrolysis by means of calorimetrical measurement. The waste samples were used in experimental runs, and then the influence of temperature toward the solid yields were investigated. The enthalpy of solid yields formation would be presented by calorific/heating value of formed char/solid yields indicating an important-physical properties of fuel. The results referred that the values of solid yield enthalpy were pointed in a polynomial function indicating endothermic and exothermic reaction during pyrolysis. The different values exhibited that the solid yield enthalpy was also a temperature function, ∆H(T). It ought to replace the ∆H as temperature function in the heat energy balance governing equation. Consequently, the pyrolysis enthalpy could not only assume as endothermic values like in the previous investigations [6,8,11] but also establish both endothermic and exothermic values in globally pyrolysis process.

**Keywords:** *Enthalpy; Solid yield; Waste; Pyrolysis*

**Combustion of Synthetic Gas with Diesel in A Single Cylinder Compression**

**Ignition Engine**

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**Abstract**― Replacing diesel fuel with alternative like syngas from biomass can help mitigating problems related to depletion of fossil fuels and emissions. However, syngas from biomass gasification is known for its fluctuation of content and composition due to complex parameters involving syngas composition, temperature, emission and calorific value. In this paper, imitated syngas is burned in a diesel engine, and the performance is analysed. The resulting dual fuel mode showed that in comparison to 100% diesel, syngas will reduce the brake power of the engine.

**Keywords:** *Diesel engine; syngas; biomass gasification; dual fuel*

**The Influence of Hydrogen Addition to Diesel Fuel Sprays Combustion For**

**Different Atomization Conditions**

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**Abstract**― The negative effects of hydrocarbon fuels are widely highlighted by increasing global warming and declining quality of human health. Therefore, it is important to reduce the level of emissions from liquid hydrocarbon combustion. Hydrogen addition to the combustion chamber is one of the proven methods to improve emssions level. In this research, an experiment was conducted on diesel fuel spray combustion with hydrogen addition. The effect of additional hydrogen was observed on CO, CO2, NO and THC exhaust gas emissions. A small hydrogen fraction (0~3 vol %) was added to the rich premixed spray combustion. The results show that increasing the hydrogen fraction reduced the emission indexes of CO and THC, and increased the emission index of CO2. Increasing the hydrogen fraction caused an increase in the emission index of NO, but the actual physical amount was insignificant. Increasing the atomizing air flow rate reduced the CO and THC emission indexes, but increased the CO2 and NO emission indexes.

**Keywords:** *spray combustion; additional hydrogen; atomization; emission index*

**Air to air ejector with various divergent mixing chambers**

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**Abstract**― The article deals with experimental investigation of subsonic air to air ejector with various configurations of the mixing chamber and the diffuser. A constant mixing chamber, 2° and 4° divergent mixing chambers and 6° diffuser were applied to find differences in the mixing process. Characteristics of the ejector, static pressure distributions and pressure fluctuations were measured to find how the different shape of the mixing chamber affect the efficiency of mixing processes. Pressure fluctuation increased rapidly while the ejection ratio was higher than 1.25 and the highest efficiency of the ejector was obtained when using configuration ”4-4-

6”.

**Keywords:** *air ejector; diffuser; mixing chamber*

**The Effect of Nozzle Configuration on Characteristics of Fluidic Excited Jets**

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**Abstract**― Using fluidic self-excited jets increases the rate of fluid mixing and reduces fuel consumption in industry burners (torches) and combustion chambers. The geometry of such jets is an important factor for fluidic jet determination. This study is concerned with investigating the types of fluidic nozzles configuration. The effect of nozzle configuration types was studied on various parameters such as frequency, velocity profile, velocity decay rate, the half angle of jet spread, and entrainment ratio. Maximum frequency and excited oscillation amplitude of fluidic jets were observed in the original geometry configuration. Also, the maximum spread rate and minimum velocity profile were observed in this geometry. Velocity decay rate shows its maximum magnitude in the original geometry configuration. Turbulence intensity reaches its maximum value in this geometry without any internal nozzle, whereas it shows the minimum value at geometry with an additional wall along the internal nozzle. The maximum increase in the half angle of jet spread was seen in the original geometry configuration. In this geometry, entrainment ratio is less than one, while in the geometry, to create steady jets, entrainment ratio is more than one.

**Keywords:** *Excited jets; fluidic nozzle configuration; jet spread*

**Reactive Mixing Behavior of the Nitration of Glycerin in a Stirred Vessel at Various**

**Perturbation**

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**Abstract**―Mixing processes are best understood in turbulent flows, where, ironically they are only understood in a statistical sense. Similarly, detailed analysis of the mechanisms of the realistic mixing process in deterministic laminar flows is nearly absent from literature. This experiment was implemented to investigate the comparable performance of reactive mixing at various perturbation; including continuous, periodic and chaotic. The experiment was designed to reveal the effects of perturbations on glycerin dissolution in nitric acid in stirred vessel. The ratio of glycerin (C3H5 (OH)3) to nitric acid (HNO3) is 1 : 3. The geometrical parameter was set to R1/R2 = 37.5/7, and an eccentricity of ε = 18.75 mm. The mixing time for dissolving fixed amounts of glycerin in fixed amounts of nitric acid was measured and compared to those from several different perturbations. It was found that mixing time for the exothermic reaction of glycerin nitration had been influenced by perturbations applied to fluid mixing. Comparable experiments have shown that mixing time in the glycerin-nitration reaction could be changed dramatically, along with various perturbations. This experiment results explicitly demonstrate the benefits of mixing performance from chaotic perturbations.

**Keywords:** *reactive mixing; nitration; glycerin; stirred vessel; perturbation*

**Performance of Conical Diffuser on Liquid Gas Ejector**

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**Abstract**― Liquid gas ejectors use a liquid as a motive fluid and a gas as an entrained fluid. The presence of the gas in the liquid reduces the performance of the ejector, especially the diffuser. To observe the effects of entrained gas on the diffuser performance, a series of experiments was conducted. In this research, the motive flow rates were varied from 1.52 l/s to 2.02 l/s and the entrained rates from 0.118 l/s to 0.944 l/s. The effects on the pressure profile and pressure recovery were observed. The entrainment rate increase consequently increase the pressure at the upstream of diffuser, as well as downstream. The pressure recovery is mainly affected by void fraction. The higher the void fraction the lower the pressure recovery coefficient will be.

**Keywords:** *ejector; diffuser; pressure recovery; void fraction; downward flow; two-phase flow*

**The Effect of Water Droplet Size on the Extinguished Concentric Jet Premixed and**

**Diffusion Flame**

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**Abstract**― The present research experimentally investigated the effect of different water droplet size on the burning behavior and extinction condition of concentric jet premixed and diffusion flame. Water droplet stream in line with flowing air from lower duct. The burning behavior of concentric jet flame was observed and the extinction of flame was gained by decreasing the flow rate of fuel until the flame exthinguised. The results showed that the burning behavior of concentric jet diffusion and premixed flame had the same tendency. Different water droplet size influenced the burning behavior of flame. Decreasing the water droplet size, luminosity of the flame became thin as well as reducing the flame height. However, the inhibition effect of water droplet was stronger for diffusion flame compared to premixed flame. For smaller water droplet size, water droplet was four times more effective for suppressing the diffusion flame than premixed flame

**Keywords:** *Water Droplet size; Concentric Jet Flame; Premixed Flame; Diffusion Flame*

**Investigation of Natural Gas Composition Effects on Knock Phenomenon in SI Gas**

**Engines using Detailed Chemistry**

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**Abstract**―Considering the growing role of natural gas as an alternative fuel in stationary and automobile engines and the differences in its composition, the influence of natural gas composition on knocking combustion in spark ignition gas engines is studied both experimentally and by employing detailed chemistry. A SI single cylinder gas engine with variable compression ratio has been used for experimental observations. The chemical scheme is embedded into a zero-dimensional model which employ three-zone approach. The scheme is used to simulate the post-flame heat release and pre-flame auto-ignition. The reactions in burning zone are modeled by chemical equilibrium calculations. The simulated results are in good agreement with the experimental observations.

**Keywords:** *Auto-ignition; Detailed Chemical Kinetics; Knock; SI Gas Engines*

**Influence of Bioethanol–gasoline blended fuel on performance and emissions characteristics from port injection Sinjai Engine 650 cc**

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**Abstract**― Performance and emissions characteristics from port injection SINJAI engine 650 cc operating on bioethanol-gasoline blended fuels of 0%, 5%, 10%, 15% and 20% were investigated on water brake dynamometers with power capacity 120 hp. The properties of bioethanol were measured based on American Society for Testing Materials (ASTM) standards. Fuel consumption was measured by the time fuel consumption per 25 cc of fuel in a measuring glass whereas combustion air consumption was measured using an air flow meter. The emission parameters, exhaust gas temperature and air fuel ratio were measured using STARGAS exhaust gas analyzer. The increase of bioethanol content will increases the engine performance and reduces pollutant emission. The highest engine performance produced by E15 blended fuel with increased torsi, mean effective pressure and power output of 10,27%, thermal efficiency 1,8% but specific fuel consumption increased approximately 12,42%. This condition occurs at engine speed 3000 - 3500 rpm. While the emission CO and HC emissions decreased significantly as a result of the leaning effect caused by the bioethanol addition. In this study, it was found that using bioetanol-gasoline blended fuels, the CO and HC emissions would be reduced appoximatelly by 55 and 32% respectively.

**Keywords:** *SINJAI engine; bioethanol; gasoline; blended fuel; performance; emission*

**Flammability Limit and Flame Visualization of Gaseous Fuel Combustion Inside**

**Meso-scale Combustor with Different Thermal Conductivity**

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**Abstract**― This study experimentally investigated effect of thermal conductivity on the combustion characteristics of gaseous fuel inside a meso-scale combustor. Combustion characteristics that were observed in this research include flame visualization and flammability limit. Quartz glass, stainless steel and copper tubes with inner diameters of 3.5 mm were used as combustors. Stainless steel wire mesh was inserted inside meso- scale combustor as a flame holder. Liquid petroleum gas (LPG), which is common fuel use by Indonesian people, was used as a gaseous fuel. A stable blue flame was established inside meso-scale combustor at the downstream of wire mesh for all combustor with different thermal conductivity. Furthermore, flame color is blue for combustion of fuel lean or stoichiometric mixture, and blue-green for combustion of fuel rich mixture. Meso-scale combustor with the highest thermal conductivity has the narrowest flame cross section area, especially at lower reactant velocity. Vice versa, this combustor has the widest flammability limit, mainly at the higher reactant velocity.

**Keywords:** *flammability limit; flame visualization; meso-scale combustor; thermal conductivity; gaseous fuel*

**Optimization of biodiesel production from calophyllum inophyllum oil with high free fatty acid**

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**Abstract**―In the present study, calophyllum inophyllum oil has been evaluated as a potential feedstock for biodiesel production. Calophyllum inophyllum oil has high acid value which is 59.30 mg KOH/g (FFA of 29.65%). Therefore, the degumming, esterification, neutralization and transesterification process are carried out to reduce the acid value to 0.34 mg KOH/g. The various variables optimization parameter such as methanol to oil ratio, catalyst concentration, reaction time, reaction temperature and speed agitation were conducted. The optimum yield was obtained at 9:1 methanol to oil ratio with 1 %wt. NaOH catalyst at 50 oC for 2 hours. However, the biodiesel fuel properties from produced calophyllum inophyllum biodiesel properties such as density, kinematic viscosity, cetane number, flash point and iodine value fulfilled the specification of ASTM D6751 and EN 14214 biodiesel standards.

**Keywords:** *Biodiesel; crude calophyllum inophyllum oil; optimization*

**Techno-economic and sensitivity analysis of jatropha curcas and calophyllum inophyllum biodiesel production**

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**Abstract**― The world is confronted with fossil fuel depletion and environmental degradation. Biodiesel is a solution for oil shortage, global warming and air pollution that can be used in compression ignition engine without any modification. The commercialization of biodiesel is yet to be undertaken at a large scale in many developing countries. Besides the technological viability, the economic feasibility also plays a very important role on the biodiesel development. Thus, this study focuses on techno-economic analysis of biodiesel production from non- edible oil as biofuel for road transport. Life cycle cost and sensitivity analysis model are developed to analyze the biodiesel production cost. The total production cost for a 50 ktons biodiesel production plant are $584 and $604 million for jatropha curcas and calophyllum inophyllum biodiesel respectively over 20 years of life time. The largest economic factor for biodiesel production is the feedstock and the variation in feedstock price will significantly affect the final production cost. The payback period for jatropha curcas and calophyllum inophyllum biodiesel was found to be 1.90 and 1.98 years respectively. Besides, it is found that biodiesel fuel is competitive with fossil diesel when the subsidy policy and tax exemption are implemented. As a final note, further studies and investigations on biodiesel production and other limitation factors are needed to be carried out before the wider utilization of biodiesel fuel in the future.

**Keywords:** *Techno-economic; Life Cycle Cost; Biodiesel; Alternative Energy; Sensitivity analysis*

**Study on Auto-ignition Behavior of Lubricating Oil in a Cone Calorimeter**

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**Abstract**― Auto-ignition behavior of lubricating oil is studied experimentally using a cone calorimeter. The adopted lubricating oil is an unknown mixture that available in the market and known to have flash point temperature of 228oC based on Material Safety Data Sheet (MSDS). The measured temperatures of auto-ignition behavior range from 350 ◦C to 550 ◦C at atmospheric pressure. The result of this study shows that the auto- ignition behavior of lubricating oil is strongly depend on condition of gas mixture consisting of oil vapor, nitrogen, and oxygen. Lubricating oil starts to ignite under heat flux of 16,66 kW/m2 at irradiance temperature of cone heater at 500 oC. Smoke optical density as result of ignition process is measured at auto-ignition temperature. Moreover, time to ignition, heat release rate and combustion phenomena are observed for each irradiance level.

**Keywords:** *auto-ignition; cone calorimeter; heat release rate; lubricating oil; optical density*

**Carbon Dioxide Effects On The Flammability Characteristics Of Biogas**

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**Abstract**―Flammability limits and flame speed of methane-carbon dioxide-air mixtures have been studied to understand the effect of carbondioxide on flammability characteristic of biogas. The fuel of biogas discussed in this study was made by mixing gases of methane and carbon dioxide. The carbon dioxide was varied from 0% (by volume) untill reach the flammability limit of the stoikhiometri biogas-air mixtures. The observation was done using a cubic combustion bomb with the dimension of 500 mm x 200 mm x 10 mm with the initial condition being at room temperature and atmospheric pressure. The ignitor was set at the top of combustion bomb, so the flame propagated downward. Base on the observation results, the presence of carbon dioxide in the fuel of biogas caused the flammability limits of biogas–air mixture narrower. The biogas-air mixture was still flammable with the highest content of carbon dioxide of 62.5 %vol when the mixture was sthoichiometri. Compared to methane-air mixture, the presence of carbon dioxide in biogas caused a reduction in the flame speed. The stoichiometri mixture has the highest flame speed when the carbon dioxide was not present in the fuel. However, when the carbon dioxide was added in the fuel, the rich mixture has the highest flame speed. This is a consequence of the rich biogas-air mixture having a higher fraction of the carbon dioxide components from the fuel compared to the stoichiometri and lean biogas-air mixture. The result also indicated that at the upper limit the flame still propagated downward to closed to the endwall. However, at the lower limit (lean mixtures), the flame did not intend to propagate downward, it was just at the top and propagate sideward.

**Keywords:** *biogas; methane; carbon dioxide; flammability characteristics*

**Biogas Potential of Co-Substrates in Balinese Biogas Plants**

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**Abstract**― This research aims to give an overview on how to improve the biogas yeild in Balinese digester plants using various co-substrates which are available in Bali. A series testing on the digestibility of substrates were set up either in the field or in the biogas laboratory. In-field analyses like testing the CO2-content and taking samples from digested manure were undertaken. Analyses such as dry matter (DM) and organic dry matter (oDM) determination, pH measurement and FOS/TAC were handled in the biogas laboratory. The huge number of different fruits in Bali gives a good opportunity to use their wastes like Durian hulls and Banana peelings, which can not be used anymore, as co-substrates in biogas plants. The results of these investigations allow to estimate the additional biogas yield, when adding co-substrates to a cow manure biogas plant.

**Keywords:** *co-substrate; biogas; anaerobic; digestion; biogas yield; Indonesia; improvement*

**Production of Ethanol As A Renewable Energy by Extractive Fermentation**

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**Abstract**― One issue with batch fermentation is that product inhibition causes low yields and ethanol productivity. The objective of this study was to increase the yield and ethanol productivity via continuous fermentation in a packed bed bioreactor with both an integrated extraction process and recycling of the raffinate into the fermenter. Molasses was used as the feedstock, and the immobilized cells were supported by ĸ- carrageenan. This process used n-amyl alcohol, 1-octanol, and 1-dodecanol as solvents. The yield and ethanol productivity increased from 8.79% to 20.03% and 34.54 g/L•h to 118.16 g/L•h for experiments using n-amyl alcohol, 9.05% to 12.67% and 35.59 g/L•h to 74.71 g/L•h, for 1-dodecanol, 8.89% to 13.45% and 34.93 g/L•h to

84.62 g/L•h, for1-octanol by increasing recycle ratio from 0 to 0.5. Based on these results, n-amyl alcohol was the best solvent for the extractive fermentation process

**Keywords:** *ethanol; molasses; immobilization cell; packed-bed bioreactor; extractive fermentation*

**Electrolyzer Performance with Sodium Bicarbonate Catalytic on Mass Fraction**

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**Abstract**― Water is a chemical compound with chemical formula H2O. Water can be split constituent elements, namely hydrogen (H2) and oxygen (O2) through the process of electrolysis. Electrolysis is a chemical process that converts electrical energy into chemical energy. In this study, an electrolyzer with six pieces of electrodes was used. The electrode is made from 304L SS. The water media was pure aquadest and aquadest with catalyst. The catalyst was NaHCO3 (Sodium Bicarbonate). The results indicated that reactions without catalysts consumed very large power of 353.52 Watts to produce Brown’s Gas with flow rate of 0.00123 l/s. When NaHCO3 was added to the water with the mass fraction of 1.33%, however, it only consumed power of 27.89 Watts to produce 0.0017 l/s Brow’s Gas. As for the efficiency without using catalyst has the greatest efficiency only 5.53% by using current of 2 Amperes and power reached 31.043 Watts. While the addition of catalysts has greatest efficiency reached

40.29% in the use of mass fraction of catalyst 1.5%, 6 Ampere currents and power of 19.829 Watts.

**Keywords:** *Electrolysis; Browns gas; NaHCO3; Flow rate; Efficiency*

**Heat Exchanger and Fluid Mechanics**

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**Abstract**― The aim of this paper is to develop a heat transfer system that can take heated water from a customer’s factory and cool it so it can be redistributed around there site. The design will be developed by creating a 3D model of the entire heat transfer system and using then SolidWorks flow simulation and hand calculations the design will be analysed on how effective it is and whether it meets the customers needs.

**Keywords:** *Heat Exchanger; Heat Transfer; Mass Transfer; Fluid Mechanics; Computational Fluid Dynamics; SolidWorks; Flow Simulation*

**Thermodynamic Analysis of Ejector as an Expansion Device on Split-type Air**

**Conditioner Using R410A as Working Fluid**

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**Abstract**― Typically the split-type air conditioner uses a capillary tube as expansion device. To enhance the performance of the system, an ejector can be applied as expansion device to replace capillary tube. Based on the numerical modeling, the coefficient of performance (COP) of standard cycle using R410A as working fluid was slightly lower than that of R22. The use of an ejector as an expansion device on a split-type air conditioner using R410 increased the COP by 10.8%. Also, R410A has a lower total GWP impact compared with R22, which reduce negative impact on the environment.

**Keywords:** *Ejector; R410A; expansion device; capillary tube; air conditioner*

**Case Studies Thermal Analysis of HP Condensate Stabilizer Column**

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**Abstract**―PT Badak NGL (PTB) is a producer of Liquefied Natural Gas (LNG) which is located in East Kalimantan, Indonesia. Total production capacity is 22.5 MTPA of LNG and 1.02 MTPA of LPG. PTB recieves gas from gas producers contain small amount of liquid hydrocarbon. The liquid hydrocarbon is separated in Knock Our Drum (KOD) then to be stabilized in the condensate stabilizer unit that consist of two distillation column operates in Low (LP) and High Pressure (HP). Such liquid hydrocarbons namely Badak Return Condensate (BRC) is sent back to gas producer

Since there are changes in feed gas both quantity and quality, therefore the HP column performance is reduced. The column has been operated at 70% of its design capacity and achievement of targeted Reid Vapor Pressure

(RVP) is only 64.6%. Thermal analysis indicated that about 3 Gcal/hr is not used effectively in the condensate stabilizer unit.

To solve the problem, it is conducted a study using column thermal analysis. The thermal analysis has been conducted based on some developed case studies. From those alternatives, it is concluded that the optimum operating condition of HP column can be achieved by relocating the liquid feed from tray#1 to tray#2, vapour feed relocation and followed by operating mode adjustment. The operating mode adjustment is conducted by re-setting the flow and temperature of the feed. The proposed modification and operating mode adjustment can improve the effectivity of enegy utilization in HP column as much as 3 Gcal/hr while the RVP can be maintained at 8 Psia.

**Keywords:** *CGCC; Column; Condensate; Distillation; LNG; PNMTC; RVP; Thermal Analysis*

**Experimental Studies on a Solar Air Heater Having V-Corrugated Absorber Plate with Obstacles Bent Vertically**

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**Abstract**― A solar air heater (SAH) is a simple heater using solar radiation that is useful for drying or space heating. Unfortunately, heat transfer from the absorber plate to the air inside the solar air heater is low. Some researchers reported that obstacles are able to improve the heat transfer in a flat plate solar air collector and others found that a v-corrugated absorber plate gives better heat transfer than a flat plate. Yet, no work of combining these two findings is found.

This paper describes the result of experimental study on a SAH with v-corrugated absorber plate and obstacles bent vertically started from 80o to 0o with interval 10o on its bottom plate. Experiments were conducted indoor

at five different Reynolds numbers (1447 ≤ Re ≤ 7237) and three different radiation intensities (430, 573, and 716

W/m2).

It is found that the obstacles improve SAH performance. Both the air temperature rise and efficiency increase with inserting obstacles bent at any angle vertically. Unfortunately, the air pressure drop is increasing, too. Obstacles bent vertically at smaller angle (means more straight) give higher air temperature rise and efficiency. However, the optimum angle is found 30o. The air temperature rise and efficiency will be 5.3% lower when the obstacles bent 30o instead of 0o, but the pressure drop will be 17.2% lower.

**Keywords:** *solar air heater; obstacle; solar collector; v-corrugated absorber plate*

**Heat Transfer Effectiveness And Coefficient Of Pressure Drop On The Shell Side Of**

**A Staggered Elliptical Tubes Bank**

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**Abstract**― The effectiveness of heat transfer and the pressure drop coefficient of staggered elliptical tube banks are studied experimentally. The bank consists of 11 elliptical tubes of 0.75” equivalent diameter in an arrangement of 4-3-4. The major and the minor sub-axis of each tube are 24.70 mm and 12.35 mm respectively, and therefore the aspect ratio (AR) of the tube is 2.0. The geometric parameters of the bank are ST = 24.70 mm, SL = 37.00 mm and minimum frontal area B = 12.35 mm. Seven mid-tubes are internally heated by electrical heater of 69.6 Watt each. Experiment is conducted in a sub sonic wind tunnel and run with the wind velocities of

1 m/s – 12.6 m/s which correspond with Reynolds number of = 346-6904. The results show that the effectiveness (ε) varied from 2144.44 to 15.26. It decreases exponentially at low Reynolds numbers and tended asymptotically at higher Reynolds number. The coefficient of pressure drop (CΔp) ranges from 7.21 to 4.41 decreases continuously at low Reynolds number and asymptotic at higher one.

**Keywords:** *staggered elliptical tube bank; aspect ratio; geometric parameters; effectiveness and coefficient of pressure drop*

**Design of an intelligent solar power converter for an educational display unit**

Dani Harmanto and Amar Bousbaine *University of Derby,United Kingdom* [d.harmanto@derby.ac.uk](mailto:harmanto@derby.ac.uk)

**Abstract**―The solar power converter for an educational display unit is used to demonstrate power electronics and renewable energy concepts. The paper involves a solar panel, power electronic converters (buck converter) and a microcontroller to provide the critical control strategies for the complete system. The application provides a platform for the user to view in real time the main parameters such as power used, voltage, current, efficiency, duty cycle and frequency.

**Keywords:** *DC-DC converter; solar; power; simulink; power ; lectronics; renewable*

**Solar Driven Absorption Chiller for Medium Temperature Food Refrigeration, a**

**Study for Application in Indonesia**

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**Abstract**― Indonesia has abundant renewable energy resources. In 2005 this country, however, only consumed

0.38% renewable energy of the total energy consumption. Most of the energy sources of the country are from fossil fuels which result in high CO2 emissions. Solar energy systems would be as an option to reduce the CO2 emissions

of this country. This paper studied the application of solar energy to provide cooling for medium temperature food refrigeration based on Indonesian weather conditions. The paper additionally analyzed the environmental impact relating to CO2 emissions, and investigated the economical aspect. CFD-Fluent software was applied on modeling

the modification of the absorption chiller generator to enable it to operate with heat from solar radiatio n, while F-Chart and Microsoft Excel spreadsheet were used to analyze the solar system and the economical viability of the technology. The results showed that the optimum modification of the absorption chiller was to use a jacket for

heat addition. CFD modeling with Fluent using Diphyl THT as the heat transfer fluid (HTF) indicated that the system would function optimally at fluid temperature input of 180oC, whereas the optimum average temperature of the chiller generator would be 170 oC. The proposed technology was found economically less viable for food refrigeration compared to the vapor compression cycle using R-404A but it could provide a significant impact on the environment by a reduction of 37% CO2 emissions.

**Keywords:** *Absorption chiller; food refrigeration; medium temperature; solar driven*

**Experimental Investigation on the Use of Secondary Refrigerant In Freezer for**

**Energy Savings**

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**Abstract**― This study presents an experimental study on a freezer which has small cooling capacity. Typically a freezer uses primary refrigerant (direct cooling) to cool or freeze a product. In this study, a prototype of freezer using a compressor 250 W nominal power at 220V was designed and constructed. The freezer is operated on two conditions, that is, using primary and secondary refrigerant. R22 and R290 (propane) were used as primary refrigerant, whereas aqueous solution of propylene glycol as secondary refrigerant. Comparison of the system performance between the primary and the secondary refrigerant werepresented. Also, the experimental results showed that the use of R290 as primary refrigerant to replace R22 in the freezer could save electrical power consumption by 18.5%. Meanwhile, the use of the secondary refrigerant yielded energy savings by 33.19% compared with the primary refrigerant.

**Keywords:** *Primary refrigerant; secondary refrigerant; freezer; energy savings*

**Redesign ITS Central Library Through Smart Building**

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**Abstract**―Energy conservation is one of many technique applied to reduce the global warming effect. Sepuluh Nopember Institute of Technology (ITS) contributes to encourage energy conservation by ITS Eco Campus programs. It has so many activities, one of them is audit energy as one way to get energy efficiency in educational area. ITS central library is most accessable building both student and other academics community with total area more than 400 square matres and high occupation rate approximately 90% everyday. Energy audit techniques were carried out by an energy audit team to identify any energy conservation opportunities (ECOs). walk-through assessment and data analysis were conducted over all building zones. These levels of assessments proved that the building and its mechanical and electrical systems were improperly maintained and inefficiently operated. So that, ITS Central Library will be redesigned to be smart building by improving light intentensity level, humidity, and room temperature appropriate with ASHRAE 90.1-2005. Thus exterior building like wall, glass, roof and floor will be redesigned to emphasize minimum total load. Replacement single glass to double glass reduce the load conduction and radiation through glass, approximately 2,7%.

**Keywords:** *energy conservation; ITS central library; energy audit*

**Numerical Studies on R22 Refrigerant Compressor Using Environment Friendly**

**Working Fluids**

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**Abstract**― Vapour compression refrigeration is the most widely used method in domestic and commercial air conditioning and refrigeration systems. R22 (difluoromonochloromethane) is the most widely used HCFC (hydro chlorofluorocarbon) refrigerant in residential, commercial, industrial and transport cooling systems. Montreal protocol in 1987 banned the use of CFCs (chlorofluorocarbon) due to their adverse impact on the environment causing ozone depletion and global warming. HCFCs are also being phased out, though they are less destructive than CFCs. The present work explores compressor performance using alternate environment friendly working fluids so that R22 can be replaced in future. The refrigerants used for the studies are R134a (tetrafluoroethane), R290 (propane) and R600a (isobutane). Compressor performance is analysed by varying refrigerant mass flow rate, evaporator and condenser temperatures and studying their effect on compressor size, power and discharge temperature. A numerical simulation code has been developed in MATLAB using refrigerant properties taken from REFPROP.

**Keywords**: *vapor compression refrigeration; compressor; alternate refrigerants; numerical simulation*

**Energy Savings in Air Conditioning System Using Ejector: an Overview**

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**Abstract**― There are two ejector configurations described in the present study: ejector refrigeration cycle and the ejector as an expansion device. The use of waste heat from the car engine and industry as a heat-driven energy for air conditioning system in automobile and building can save energy. Although the ejector refrigeration cycle has a low COP, the use of waste heat as a heat-driven energy incurs a lower operational cost compared with vapor compression refrigeration system. In addition, an ejector as an expansion device can be applied in the vapor compression refrigeration cycle to improve the performance system

**Keywords**: *Ejector refrigeration cycle; ejector-expansion; refrigeration cycle; COP; air conditioner*

**Empirical Correlations for Sizing Adiabatic Capillary Tube using LPG as Refrigerant in Split-Type Air-conditioner**

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**Abstract**― This paper presents correlations for sizing adiabatic capillary tubes which serves as an expansion device in split-type air-conditioner with LPG, novel hydrocarbon (HC) mixtures of butane (HC600) and propane (HC290) as refrigerant. A homogenous two-phase flow model developed by the authors and also experimental investigation of the Liquified Petroluem Gas (LPG) refrigerant flow in adiabatic capillary tubes were used in this study. The theoretical model was used to assess various percentage compositions of these HC mixtures and validated with the experimental data. For each HC refrigerant mixture, correlations for sizing adiabatic capillary tube which contains the relevant factors, viz. capillary tube inner diameter, inlet pressure, refrigerant mass flow rate, capillary tube surface roughness and capillary tube inlet subcooling was developed. The proposed correlations were compared with the authors measured data and found to be in good agreement. Further validation was made by comparing the mass flow rates predictions of the correlations with experimental data of previous studies and found that these correlations are consistent. The correlations can be used in small vapour compression refrigeration systems working with the HC refrigerant mixtures for practical design and optimization.

**Keywords:** *Capillary tube; Split-type air-conditioner; LPG; Hydrocarbons; Empirical correlation*

**Experimental Study on the Performance of In-Cabin Ventilation System**

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**Abstract**― Parking a car under the hot sun with all windows closed could increase in-cabin temperature as high as 70oC. For such situation, human occupancy will exposed to thermal shock and inconvenience when embarking the vehicle. Another concerned of this accumulated heat gain is the effect of gas emitted by the interior material which mostly is made of vinyl. These experimental studies try to look the possibilities of bringing down the temperature and hence to suit human habitation. In this study, two methods were implemented and they are by creating fresh air change and introducing evaporative cooling by generating water mist in the air flow for further enhancement of temperature drop. Fully automated control strategy was used based on in-cabin temperature activation by the assistance of electronic control unit (ECU). Observation was made and compare for original car condition and the one equipped with In-Cabin Ventilation (IVS). The result shows the car cabin temperature can reach as high as 65oC without ventilation. With fresh charged of air and evaporative cooling, temperature drops to a range of 40 to 50oC.

**Keywords**in- *cabin car cooling; air-change; evaporative cooling*

**Improved Energy Saving for R22 Building Air Conditioning Retrofitted With**

**Hydrocarbon Refrigerant, Study Case : Civil Engineering Department of ITS**

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**Abstract**― Sepuluh November Institute of Technology (ITS) encourages the ECO Campus program. The program enables ITS to systematically identify, evaluate, manage and improve their environmental performance and practices. One of the program issue is energy saving in building. The energy saving effect of an air-conditioning system retrofit project is analyzed by Energy Conservation Opportunities (ECOs) Method. These ECOs are assessed in terms of their costs and benefits, and an economic comparison to rank the various refrigerants. Finally, an Action Plan is created where certain ECOs are selected for implementation. Civil Engineering Department has a responsibility to design infrastructure and green building concept planning. This department also has the largest energy consumption in this faculty comparing the other department. The energy consumption on this Department is 42034.85 kWh/month. The value of IKE is 9.26 per month with the largest electrical energy consumption in air-conditioning system is 57% from total consumption. The energy used of air-conditioning sytem is 523.692 kWh. The energy saving opportunities by CFC retrofitting with hydrocarbon can save its power consumption about 20%. It’s also saving cost and reducing the electricity bill of 1643871.838 IDR/month. The payback period of investment costs of retrofit R-22 to Hydrocarbon is about 13 month

**Keywords**in- *global warming; Civil Engineering Department retrofit; energy consumption opportunities (ECO)*

**Driving Efficiency Through Hydrocarbon For Green Car Air Conditioning**

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**Abstract**―The feasibility of hydrocarbon mixtures to replace HFC-R134a in automotive air conditioning systems is investigated in this paper. The temperature distribution in car cabin and fuel consumption are evaluated at various passenger load and vehicle speeds using hydrofluorocarbons refrigerant (HFC-R134a) and hydrocarbon refrigerant as the working fluid of the compressor. The experiments are tested in an actual petrol engine vehicle on a roller dynamometer to simulate actual vehicle on level road. The experiments are conducted at the same surrounding conditions. The test has performed by varying the vehicle speed; 50, 70, 90 and 110 kph, and number of passengers; 1 and 2, at temperature set-point of 21oC. The result shows that the hydrocarbon mixtures provide excellent temperature distribution and fuel conservation effect is about 2.95% to 11.90%. In addition, the results support the possibility of using hydrocarbon mixtures as an alternative to HFC-R134a in the automotive air conditioning system, without the necessity of changing parts in the current system.

**Keywords:** *Efficiency; hydrocarbon mixture; green car; automotive air conditioning*

**Effect of Air Conditioning Position on Thermal Comfort in the Floor Air**

**Conditioning System**

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**Abstract**― FAC system (Floor Air Conditioning) is growing because it is more energy efficient than CAC (Ceiling Air Conditioning) system. However, the position of the AC supply is on the lower level at the FAC system causes draft discomfort becomes greater as air supply closer to the occupants so that thermal comfort can be reduced. This study aims to determine the position of the AC supply which has the best thermal comfort of FAC system in the studio apartment. It can be done by analyzing ADPI (Air Diffusion Performance Index), the distribution of air temperature, wind speed, RH (Relative Humidity), and DR (Draft Risk) to change the position of the AC supply supported by CFD (Computational Fluid Dynamics) simulation.

This result prove that AC position 2 (on wall near the kitchen) is more comfortable than AC position 1 (on the bathroom wall) because AC position 2 away from occupied areas, thereby reducing the occurrence of draft

discomfort.

**Keywords:** *Air Diffusion Performance Index (ADPI); Apartment; Draft Risk (DR); Floor Air Conditioning (FAC); Thermal Comfort*

**Use of CFD to Study Drag Force on a Land Speed Record Motorcycle**

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**Abstract**― Reduction of aerodynamic drag is of vital importance when competing for outright maximum speeds, as with land speed vehicles. Computational fluid dynamics is often used when designing and developing aerodynamic bodies. A simplified CAD model of a streamlined motorcycle has been produced and CFD software used to evaluate the amount of drag force the vehicle produces.

**Keywords:** *CFD; Computational Fluid Dynamics; Land Speed; Drag; Coefficient; Aerodynamics; Aero; Streamliner*

**Use of Computational Fluid Dynamics to Evaluate Modifications to a Historic Single**

**Seat Race Car Nose Section**

Dani Harmanto and James Kmieciak *University of Derby,United Kingdom* [d.harmanto@derby.ac.uk](mailto:harmanto@derby.ac.uk)

**Abstract**― Due to a technical regulation change, a replacement March 742 nose section providing significantly less downforce than the current fitted nose has been modelled using Solidworks 2011 from laser scanned images processed using Geo-Magic software. Downforce and drag levels have been calculated and compared using models of both nose sections using Solidworks Flow Simulation 2011 3D Computational Fluid Dynamics (CFD) software. A straight line aero test has been undertaken using GSD Racedyn vehicle kinematic and tyre software coupled with logged data to provide a correlation with the CFD results and real world application. This study shows how simplified 3D Computer Aided Design (CAD) models and CFD analysis along with a solid understanding of the interactions around an aerodynamic component can provide practical short cuts which reduce component design times while still providing acceptable results.

**Keywords:** *energy Computational Fluid Dynamics; Race Car; Aerodynamics; Nose Cone*

**Experimental study on the effect of Reynolds number variation on drag force for various cut angle on D-type cylinders**

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**Abstract**― Experimental study on the effect of Reynolds number variation on drag force for various cut angles on D-type cylinders was performed. Five different cut angles on different cylinders were applied including: 35o,

45o, 53o, 60o, and 65o. The free stream velocity was varied so the Reynolds number also varied.

The experiment was carried out at a subsonic wind tunnel. Drag force for a cut D-type cylinder (for example 35o)

was measured using a force balance and wind speed was varied so that corresponding Reynolds number of

2.4×104÷5.3×104 were achieved. Wind turning angle was kept at 0o (without turning angle). This experiment repeated for other D-type cylinders.

Experiment results show that, for all D-type cylinders, drag force decreased as the Reynolds number increased, then it was increased after attain minimum drag force. For all D-type cylinders and all variations of Reynolds

number the drag minimum is attained at cut angle of 53o. This value is appropriate with previous experiment results.

**Keywords:** *D-type cylinder; cut angle; Reynolds number; drag force*

**Flow characteristics around four circular cylinders in equispaced arrangement near a plane wall**

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**Abstract**― The flow characteristics around four circular cylinders in equispaced arrangement located near a plane wall were investigated experimentally. The pressure distributions on the each cylinder surface and on the plane wall were measured for a spacing ratio L/D= 1.5 (L, center to center spacing between cylinders; D, diameter) and G/D= 0.2 (G, gap spacing between cylinder surface and the plane wall) in a uniform flow at a Reynolds Number of 5.3 x 104. The 2D U-RANS numerical simulation with k-ω SST as viscous model was used to visualize the flow phenomena occured around the cylinders. The results showed that the flow tend to be biased on the upper side of cylinders configuration. It causes the stagnation at the upstream cylinders occured at lower side of cylinders and results a formation of a narrower wake behind the third cylinder and a wider wake behind the fourth cylinder.

**Keywords:** *equispaced arrangement; circular cylinders; plane wall*

**Reduction Of Energy Losses In The End wall Junction Area Through The Addition**

**Of Forward Facing Step Turbulent Generator**

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**Abstract**―The research was conducted in order to reduce energy losses caused by the secondary flow in the endwall junction. This phenomenon is caused by the interaction of two adjacent viscous flow (symmetric airfoil and endwall). Reduction of energy loss carried out by addition of Foward Facing Step Turbulator (FFST) in the upstream. Endwall junction area is modeled as a NACA 0015 airfoil and a flat plate. Position of FFST is at a distance L = 2/3 C upstream leading edge and a thickness d = 4% C. Free stream conditions Red = 105 with turbulence intensity (Tu) 5%. Research was conducted by numerical and experiment methods. Pathlines of numerical result methods has identic structure with "Oil Flow Visualization" of the experiment.

Result of the research states that the addition of FFST can increase the turbulence intensity in the flow near the wall. So at the same AoA looks the saddle point position on the "leading-edge" has distance nearly the same but

a little more towards the lower side. These conditions make the separation line is more open. Because the flow has stronger turbulence intensity, then attachment line both the upper side and lower side are better able to follow the contours of the body. So the point of separation can be delayed and blockage (energy loss) can be reduced. Reduction of energy loss is most effective on the AoA 8 ° (4.16%)

**Keywords:** *Secondary flow, forward facing step, turbulent intensity.*

**The Evaluation of a Rigid Sail of Ship Using Wind Tunnel Test**

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**Abstract**― This paper described the evaluation of rigid sail performances by using the wind tunnel test. The rigid sail models were developed in the three variations of shape geometry which was having the same value of aspect ratio. The tests were performed to investigate the performances of sail models in terms of lift, drag, resultant, driving and heeling coefficient. The three sail models were tested at the variation of angle of attack such as 15o,

20o and 25o respectively, and it was fluided by a uniform flow of air with three different speeds. The comparisons of test results were evaluated to look for which sail models had the best performance. Based on the test results, Model 2 which is a triangle shape had generated a maximal efficiency and thrust force compare to the other

models.

**Keywords:** *rigid sail; wind tunnel; sailing ship; renewable energy*

**Experimental Study of Drag Reduction on Circular Cylinder and Reduction of**

**Pressure Drop in Narrow Channels by Using a Cylinder Disturbance Body**

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**Abstract**― This paper present the results of drag reduction on circular cylinder and reduction of pressure drop in narrow rectangular channels by using cylinder disturbance body. This study focused on the phenomenon when the flow through the arrangement of the circular cylinder, separation will occur at a specific point on a circular cylinder resulting drag force. When the separation can be delayed so that the resulting drag force will be smaller. This can be done in various ways, one of which is by using a cylinder disturbance body on the upper and lower side near the bluff body. This study will be conducted in a wind tunnel experiments which have narrow channels with a square cross-sectional area of 125 mm x 125 mm and a blockage ratio of 26.4% and 36.4%. Specimens used circular cylinder with 25 mm diameter (d/D= 0.16) and 37.5 mm (d/D= 0.107) as well as the cylinder disturbance body shaped circular cylinder with a diameter of 4 mm. cylinder disturbance body placed on the upper and lower side with the position α=200 to 600 and spacing (δ=0.4 mm) to the main circular cylinder. Reynolds number based on the hydraulic diameter of 5.21×104 to 15.6×104. The results of this research show the effect of using cylinder disturbance body on circular cylinder and the characteristics of fluid flow on a narrow channel square cross section. At a certain position of the cylinder disturbance body provide value pressure drop reduction on narrow channels and drag reduction when compared to a single circular cylinder. From the experimental data presented in this paper it is observed that the position angle of cylinder disturbance body to reduce drag force on a circular cylinder and reducing the pressure drop in the channel are at angle 200 and 300 for D=25 mm, and 200, 300 and

400 for D= 37.5 mm then the best reduction for both cylinders are at an angle of 300.

**Keywords:** *cylinder disturbance body; circular cylinder; pressure drop; drag force*

**Numerical study on the influence of the corner curvature of circular micropillar on microdroplet size via a dewetting process**

Bambang A. Dwiyantoro

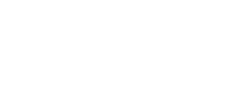
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**Abstract**― The influence of the corner curvature of circular micropillar on microdroplet formation by a dewetting process was numerically investigated. The diameter of the microdroplets is mainly determined by the capillary effect and viscous force contributed by the wetted surface i.e. on the top surface of micropillar magnifies, which slows down the movement of water front attached to the top surface of micropillar. The numerical simulations showed that the corner curvature of the micropillars play an important role in determining the flow pattern of the dewetting process, especially the evolution and movement of the meniscus across the micropillar before a microdroplet is formed. The water front on the top surface of micropillar with right-angle corner moves much slower than that on the micropillar with round corner. The numerical results also indicate that the curvature radius (r) on circular micropillar is one of the parameters governing the size of the microdroplets formed on the top surface of the micropillars after the dewetting process, while the microdroplet diameter decreases with the increase of the dimensionless of curvature corner.

**Keywords:** *corner curvature; circular micropillar; microdroplet size; dewetting process*

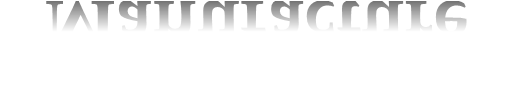
**Effects Of Pine Oil On Dynamics Of Bubble In Froth Flotation**



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**Abstract**― Abstract. Dynamics of bubble in froth flotation have been studied. This reserch purpose is to study the effects of pine oil on the dynamics of small bubble in froth flotation. The dynamics of bubble is important parameter which determine flotation eficiency. Exsperiment setup is consist of column flotation made from acrylic pipe with furnished by image capture and lighting equipments. Bubble was generated by a nozzle. Varies nozzle size and pine oil concentration are used in this experiment. The dynamics of the bubble are captured by camera and the images are processed by image processing software, therefore bubble’s size and its position can be determined. The results indicate that bubble movement can be devided into three stages: acceleration, deceleration and terminal velocity stage. Pine oil modify surface tension, hence the bubble size become smaller and its velocy decrease. Pine oil cause bubble reach terminal velocity faster then bubble in water wthout pine oil. From this result we can conclude that pine oil affects bubble dynamics significantly.

**Keywords:** *bubble dynamics; pine oil; froth flotation; terminal velocity*



**Manufacture**

**Effect Of Material And Process Parameter On Dimensions Of Rolled External**

**Threads**

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**Abstract**―The work in this paper presents the effect of material and blank dimension on the dimensions of external rolled threads. This paper will be helpful for the auto industry, one of the largest fasteners markets, that typically consumes between 2800 to 3100 fasteners in the assembly of an average family vehicle. Externally threaded fasteners comprise the bulk of fasteners used in these applications with over 90% of being produced by thread rolling. The thread rolling process is now widely acknowledged as the fastest and most efficient method of producing accurate external threads, with surface finish and mechanical properties. The typical production rates are around one piece per second. In order to ensure a perfect thread rolling process, it is important for blank of work piece to be properly pre-machined. The size of the blank is dependent on material, surface finish, type of threads etc. This paper describes the effect of blank material and dimensions on dimensions of external rolled threads. The work has been carried out at M/s Gayatri Auto Industries on Master Reciprocating Dies Thread Rolling Machine using HSS die. Mild Steel (C 15), EN 8 (C40), and EN 47 (Spring Steel) materials have been taken as blank material for the analysis to create M8x1.256g threads. The result indicates that the variation in carbon percentage and dimension of blank affects significantly the nominal diameter and PCD of threads. This paper will also be helpful for the professionals to determine the exact dimension of thread rolling blank for desired threads.

**Keywords:** *Reciprocating Die Thread Rolling Process; Automotive Industry; Fasteners ; EN 8 ; EN 47; Effect of*

*Blank Dimension and Carbon percentage*

**Evaluation of The Effect of Application of Air Jet Cooling and Cooled-Air Jet**

**Cooling on Machining Characteristics of St 60 Steel**

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**Abstract**― The use of cutting fluid is to reduce the friction between tool and workpiece, reduce and dissipate generated heat. The application of cutting fluid is also to improve the surface quality of workpiece and increase the tool life. On the other side, cutting fluid contains chemical carcinogens that causes serious health risks for machine operators and have inherent waste disposal concern on the environment. Due to these problems, some alternative have been sought to minimize or avoid the use of cutting fluid in machining processes. Air cooling techniques were proposed as alternative cooling mediums, i.e air jet cooling (AJC) and cooled-air jet cooling (CAJC), the liquid less method. In this work, air cooling techniques were investigated to be a possible solution of machining problem for cooling medium. This study was also motivated by economics point of view that the application of AJC and CAJC would be more efficient than liquid method. The purpose of this study is to investigate the effect of AJC and CAJC on turning process of St 60 steel because it is used widely for production of components especially in small and medium enterprises in Indonesia. The tool tip temperatures, surface roughness and tool wear were measured for a range of cutting times. For a comparison purposes, experiments were also carried out with using traditional liquid coolant and without any cooling applied to the tool tip (dry cutting method). Experiments have shown that air cooling techniques (AJC, and CAJC) can be used as cooling medium in machining process. Experimental results show that machining with CAJC have shorter tool life compare to machining with AJC and dry cutting, but liquid coolant in this studi is still the best cooling medium for machining of St 60 steel.

**Keywords:** *Cutting fluids; air jet cooling; cooled-air jet cooling; turning process; machining characteristics*

**Simulation of Semi-Active the Blank Holder Force Control to Prevent Wrinkling and**

**Cracking in Deep Drawing Process**

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**Abstract**― This paper presents simulation of drawing force and thickness deformation in deep drawing which employs semi-active blank holder force system, to solve the problem of cracking and wrinkling. The method of slab with feed back control failure criteria, was employed to make the modeling system and the semi-active blank holder to prevent wrinkling and cracking in forming low carbon steel sheet, without lubrication (Friction coef.=0.4). In this study, the mechanical properties of the material were chosen since that they equivalent to those of low carbon steel with its thickness of 0.2 mm, k = 572 N/mm2, UTS = 391 N/mm2, yield stress = 309 N/mm2 and n = 0.2. The diameter and the depth of the cylindrical cup-shaped product were 40 mm and 10 mm, respectively. Results from simulation have shown that the semi-active blank holder system can control very responsive against changing of deformation condition. The optimum of initial blank holder force is approximately

3000 N up to 4000 N. In the early stages (initial stroke), blank holder force system could be responsive to prevent cracking, and at the end of the punch stroke, it is very effective to prevent wrinkling. Simulation of semi-active blank holder force control system is excellent in model formation to prevent cracking and wrinkling.

**Keywords:** *Deep Drawing; Blank Holder; Cracking; Wrinkling*

**Development Machining of Titanium Alloys: A Review**

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**Abstract**― Titanium and its alloys are hard materials, wear resistant, high strength to weight ratio. Therefore this material become very promising, especially in aerospace application. However, its application restrict when face machining processes. This material is very hard which is very difficult to manufacture by machining. Its low Young’s modulus tends to springy and creates vibration or chatter. Moreover, it has low heat dissipation rate that make the heat concentrate in the tool tip especially in the friction surface between tool and chip. Those phenomena result in very low tool life and low quality of machined surface, in term of surface roughness, surface integrity. This article describes some efforts to overcome those problems. Categorically, there are some groups of effort, i.e. varying machining parameters, modification the tool, treatment of the material, and different method of applying the coolant. It seems that using cryogenic cooling upon the tool is the most promising new technology to machine the titanium alloy.

**Keywords:** *titanium alloys; machining; cryogenic cooling*

**Modal and Harmonic Response Analysis: Linear-approach Simulation to Predict the Influence of Granular Stiffeners on Dynamic Stiffness of Box-shaped Workpiece for Increasing Stability Limit Against Chatter**

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**Abstract**― Chatter is a self-excited vibration that occurs during machining process. It becomes a limitation to productivity and reduces the surface quality of work piece. Increasing dynamic stiffness of the work piece will improve its stability limit against chatter occurrence.

Initial linear-approach simulation performing finite element modal and harmonic response analysis of the work piece filled with granular stiffener (sand and gravel) is presented. Drucker-Prager granular frictional material

model is chosen to represent sand and gravel used as stiffener. Drucker-Prager parameters are chosen based on the experiment setting condition. Effect of an addition of the granular stiffener on the dynamic stiffness of the work piece will be evaluated. The simulation results are verified by experiment results.

**Keywords:** *dynamic stiffness; chatter; modal analysis; harmonic response analysis*

**Selection of Weibull Distribution for reliability analysis of band saw cutting machine (FCAF-245)**

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**Abstract**― The selection of the model for reliability analysis is very essential for failure prediction. Weibull distribution model is selected for time to failure data analysis of band saw cutting machine. Reliability, MTTF of each component is estimated. Some of the components are suggested for preventive maintenance. The reliability improvement methods can be suggested based on this analysis.

**Keywords:** *Reliability; Mean Time to Failure; Availability*

**Multiple Performance Optimization in the Wire EDM Process of SKD61 Tool Steel using Taguchi Grey Relational Analysis and Fuzzy Logic**

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**Abstract**―This paper present the optimization of the wire electrical discharge machining (WEDM) process of SKD61 tool steel (AISI H13). The use of the Taguchi method combined with grey relational analysis and fuzzy logic has been applied for optimization of multiple quality characteristics. The WEDM machining parameters (arc on time, on time, open voltage, off time and servo voltage) were optimized with considerations of multiple performance characteristics, i.e., MRR, SR and kerf. Arc on time was set at two different levels while the other four were set at three different levels. Based on Taguchi method, an L18 mixed-orthogonal array was chosen for the experiments. Experimental results have shown that machining performance characteristics of WEDM process can be improved effectively through the combination of Taguchi method and grey-fuzzy logic.

**Keywords:** *Taguchi; grey relational analysis; fuzzy logic; WEDM; SKD61*

**Optimization of Recast Layer Thickness and Surface Roughness in the Wire EDM Process of AISI H13 Tool Steel using Taguchi and Fuzzy Logic**

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**Abstract**― In this study, the optimization of recast layer thickness and surface roughness (SR) simultaneously in a Wire-EDM process by using Taguchi method with fuzzy logic has been applied. The Wire- EDM process parameters (arc on time, on time, open voltage, off time and servo voltage) were optimized with considerations of multiple performance characteristics, i.e., recast layer thickness and SR. Based on the Taguchi method, an L18 mixed-orthogonal array table was chosen for the experiments. Fuzzy reasoning of the multiple performance characteristics has been developed based on fuzzy logic, which then converted into a fuzzy reasoning grade or FRG. As a result, the optimization of complicated multiple performance characteristics was transformed into the optimization of single response performance index. Experimental results have shown that machining performance characteristics of Wire-EDM process can be improved effectively through the combination of Taguchi method and fuzzy logic.

**Keywords:** *Taguchi; fuzzy logic; wire EDM; recast layer thickness; surface roughness; AISI H13*

**Optimization of Tool Wear, Surface Roughness and Material Removal Rate in the Milling Process of Al 6061 using Taguchi and Weighted Principal Component Analysis (WPCA)**

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**Abstract**― In the metal cutting industry, end milling has an important role in cutting metal to obtain the various required shapes and size. This study takes Al 6061 as working material and investigates three performance characteristics, i.e., tool wear (VB), surface roughness (Ra) and material removal rate (MRR), with Taguchi method and WPCA for determining the optimal parameters in the end milling process. The performance characteristic of MRR is larger-the-better while VB and Ra are having smaller-the-better performance characteristic. Based on Taguchi method, an L18 mixed-orthogonal array was chosen for the experiments. The optimization was conducted by using weighted principal component analysis (WPCA). As a result, the optimization of complicated multiple performance characteristics was transformed into the optimization of single response performance index. The most significant machining parameters which affected the multiple performance characteristics were type of milling operation, spindle speed, feed rate and depth of cut. Experimental result have also shown that machining performance characteristics of end milling process can improved effectively through the combination of Taguchi method and WPCA.

**Keywords:** *end milling; weighted principal component analysis (WPCA); Taguchi method*

**Design and Application of The Stretching Technology on The Welding Process of**

**Stiffened Sheet Metal Structure**

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**Abstract**―Stiffened sheet metal structure where sheet metal is reinforced by frame has been claimed as the most effective structure because it has low volume and weight. It is generally applied to large car body structure such as bus and train body. Frame and sheet are commonly joined by welding process. Due to the local heating of welding, distortion or deformation will occur in this structure. To mitigate this distortion, new method called stretching technology was proposed in this work. In this method, sheet was stretched to certain pre-strain, kept in this condition and then welded to frame. Special equipment powered by hidroulic system was designed to support this method. Low carbon steel SPAC specimens with dimension of 400mm, 1824mm and 3mm in width, length and thick respectively were prepared to evaluate the method. Hidroulic power was controlled to meet the sheet pre-strain variations of 0.00%, 0.05%, 0.10% and 0.15%. The distortion of the specimen was measured by dial indicator with mesh point of 50mm and shown in 2D contour chart. The study results revealed that the welding process on the sheet without pre-strain had the highest distortion of 8.34mm while that with pre-strain of 0.05% provided the lowest distortion of 3,3mm or 60% lower than without pre-strain specimen. The pre-strain of 0.10% and 0.15% produced the sheet distortion of 7.05mm and 7.9mm respectively. The excessive pre-strain was an ineffective method to mitigate the welding distortion because the reverse tension force of sheet would destroy the weld joint when the hydraulic force was released.

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**Keywords:** *stretching technology; distortion; plug welding; stiffened sheet structure; prestrain*

**Effect of dry high speed end milling on surface roughness and cutting forces of Ti–**

**6Al–4V ELI**

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**Abstract**― The surface quality generated when high speed dry end milling (HSDEM) Ti-6Al-4V-ELI titanium alloy with coated and uncoated carbide tools were investigated. Evaluation was conducted using TiAlN+TiN PVD coated and uncoated cemented carbide tool under different high cutting speeds and feed rates conditions. Surface roughness and cutting forces were measured after initial machining using new tools. The milled surface quality and corresponding alteration were characterized through electron microscopy. Within the investigated conditions, high quality surface finish was obtained on the machined surface. Increasing cutting speed from 200 to 300 m/min during the process improved the surface finished particularly under lower feed rates. In term of the generated surface quality, uncoated carbide tool out performed the PVD coated tool especifically at the higher cutting conditions. The main damages observed after HSDEM on the surface for all of the machining conditions included redeposited materials, feed marks and tool edge marks. Under both tested feed rates the resultant cutting force decreased with increasing the cutting speed and uncoated carbide tools provide the lower cutting forces compared to coated tool.

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**Keywords:** *High speed; End milling; Titanium alloy; Surface roughness; Cutting force*

**The Preliminary Research of Drill Guide Template Design for Pedicle Screw**

**Placement with a Low-cost 3D Pinter**

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**Abstract**― The purpose of this study is illustrated the potential of applying the additive manufacturing (AM) technology with a low-cost three-dimensional (3D) printer on clinical applications of spine surgeries. First, the target vertebrae will be extracted from the computed tomography (CT) images of a patient and converted to a 3D polyhedral model. After choosing the target regions of pedicle screws in this 3D polyhedral model, the optimal screw angles and depths will be obtained without injuring the spinal cord. Then, a drill guide template of pedicle screws will be developed by using an AM software, and fabricated by a low-cost 3D printer. The doctor can utilize it to buckle the specific designed position of the vertebrae of the patient, and drill directly through the guide hole during the scoliosis surgery. These steps can reduce the surgical time substantially. Finally, several cases were executed to verify the placement accuracy of drill guide templates fabricated by the low-cost 3D printer.

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**Keywords:** *Additive Manufacturing; Scoliosis; Computer-Aided Method; Pedicle Screw Placement*

**Visible Light Maskless Photolithography for Biomachining Application**

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**Abstract**―Maskless photolithograpy is an alternative method of conventional UV photolithograpy for microfabrication since its advantages of time and cost saving. For this reason, a visible-light based maskless photolithograpy is proposed as a part of biomachining process. Modification of the method is done by replacing light source of UV light to visible light, utilizing commercial DLP projector and changing the material removal process that generally uses echant with biomachining process. The process was done by using the profile generated by computer then displayed through a commercial DLP projector shining speciment test. Focusing lens placed under the projector to draw the focal point and reduces the size of the profile. The best parameter was determined by setring exposure time, developing time, variation profiles, focusing, colors combination and optical aspect. Using a commercial projector maskless photolithography on a negative resist tone successfully performed. The best characteristic was obtained by placing the focusing lens 3X magnification within 3 cm below the projector and 14 cm above speciment test, color combination of black-light blue (R = 0, G = 176, B = 240), with the timing of prebake 1 minute, exposure 7 minutes, postbake 5 minutes, developing 5 minutes produces the smallest profile

166 µm with 13,7 µm deviation. Biomachining process with bacteria Acidithiobacillus ferrooxidans NBRC 14262 on copper was also successfully performed with the smallest profile of 180 µm with 26 µm deviation.

**Keywords:** *maskless; photolithography; Digital Light Processing; visible light; biomachining*

**Improvement of Tungsten Inert Gas (TIG) Welding Penetration Using the Effect of**

**Electromagnetic Field**

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**Abstract**― Tungsten Inert Gas (TIG) welding is a process which an electric arc generated by the tungsten electrode to the workpiece and the welding area protected by a protective gas. Arc shape can be affected by electromagnetic force. In previous study, the use of some electromagnetic field around the arc has influenced the welding results. In this study, electromagnetic field generated from the solenoids was given to the welding arc. Welding process was conducted on Stainless Steel. The electromagnetic field made the arc becomes deflected. This deflection was controlled by the solenoid by activating it using a microcontroller. The results showed that the use of solenoid as a source of electromagnetic field has influenced the welding arc. Penetration produced by using a solenoid has deeper penetration than welding process without using solenoid. The increase of the welding power efficiency was 10.9% for arc current I = 80 A and 9.85% for arc current I = 90 A.

**Keywords:** *Tungsten Inert Gas (TIG); Welding penetration; Electromagnetic field; Power efficiency*

**Response of Grip Force as effect of Electrical Input Power On Gripper Actuator of**

**NiTi SM495 Wire**

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**Abstract**― Gripper is mechanism that mounted on the end of the robot arm and used to hold an object and moving it to a certain position. Generally, classical gripper is equipped with the driving motor (electric, pneumatic, fluid power) to move the gripper mechanism. In this research, the function of driving motor replaced with gripper motor actuators made of Shape Memory Alloys (SMA) of Nickel Titanium (NiTi) wire type SM495. A problem studied is the response of the grip force of the gripper due to variations in electrical power to the actuator that is made of NiTi SM495. The electrical power parameters used in the experiment were obtained by varying the voltage and electrics current. Linear springs with various spring’s constants of 0.14 N/mm; 0.49 N/mm; 0.981 N/mm; 1.308 N

/mm were used for measuring grip force of gripper. Data from the experiment were obtained and analyzed. Results indicate that the power given to the actuator of NiTi affect the grip force of the gripper. The increase of power

leads to an increase of grip force.

**Keywords:** *actuators; electrical input power; grip force gripper; Nickel Titanium; Shape Memory Alloys SM495 wire*

**Application of Semi Automatic Indek Complexity Products Calculation through**

**Identification and Recognition of Information Features Geometry**

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**Abstract**―To produce a product that has a high level of competitiveness in a free market, the manufacturing industry is currently challenged to be able to produce products with low cost, short time and high quality. Opportunity to solve the problem can be achieved if the process automation design process can be done quickly in the early stages of the design process, especially by utilizing the calculation complexity of the product, process and assembly through identification and recognition of information features geometry. This research purpose is to identify the standard features that have been classified by the machining process in previous studies, for further recognition geometrical feature information which will then be used to calculate an index of the complexity of product design. The results obtained can then be used as a model of development in determining the relative complexity of a product according to the method has developed in calculating the complexity of the product. The development process begins with a depiction of the product features using devices tools such as catia, solidwork, mastercam, or other software for solid models, in form of stp or step file, then do the extraction process using notepad so acquired entity of Advance Face dan Edge Curve. It will be processed into products relative coefficients. Identification and recognition results obtained from the features that Advance Face and Edge Curves for each feature will increase as the number of features increase. The result shows the highest complexity values for rotational feature is the shape Neck (value is 6.30), the highest value of complexity for feature prismatic shape slot is 6.05, the highest value of complexity for feature pocket forms the slab is 5.66 and the value of complexity highest revolving features by 4.94. An example of the calculation of product complexity for bicycle bracket delivered in addition to the calculation of the complexity of the whole model shape features. Calculations performed can be used as a reference for the calculation complexity of the product, so it will speed up the design process. It can be concluded that the higher value of the index complexity of product features, then get more difficult shape design features.

**Keywords:** *features; recognition; complexity*

**Effect of Cutting Parameters on Surface Roughness in Turning of Bone**

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**Abstract**― Surface roughness indicates the damage of the bone tissue due to bone machining process. Aiming at inducing the least damage, this study evaluates the effect of some cutting conditions to the surface roughness of machined bone. In the turning operation performed, the variables are cutting speed (26 and 45 m/min), feed (0.05 and 0.09 mm/rev), tool type (coated and uncoated), and cutting direction (longitudinal and transversal). It was found that feed did not significantly influence surface roughness. Among the influencing factor, the rank is tool type, cutting speed, and cutting direction.

**Keywords:** *Bone Machining; Surface Roughness; Cutting Conditions; Turning*

**Multiple Performance characteristics Optimization in the Turning Process of AISI H13 Tool Steel using Taguchi and Fuzzy Logic**

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**Abstract**―This paper presents the application of Taguchi’s method of orthogonal array and signal to noise ratio with logical fuzzy reasoning for multiple output optimization of turning AISI H13 steel using carbide tool. The cutting parameters, i.e., cutting speed, feed rate, depth of cut and nose radius, are optimized with considerations of multiple performance characteristics such as cutting force, feed force, surface roughness and tool flank wear. Experimental results are provided to illustrate the effectiveness of this approach.

**Keywords:** *Fuzzy logics; Multiple performance characteristics; Taguchi method; Turning*

**Numerical Simulation of Multipoint Forming with Circular Die Pins in Hexagonal**

**Packing**

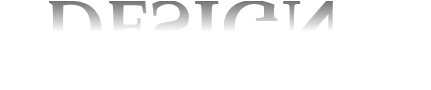
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**Abstract**― Multipoint forming (MPF) in flexible forming technology. from the previous research of multipoint forming, the configuration of the upper and lower punch matrices were configured in square packing. In this paper, model of multipoint forming configuration was developed and the numerical simulation was performed to investigate the influence of the proposed pins arrangement, hexagonal packing. The packing density in hexagonal arrangement is higher than in square one. The deformation process in multipoint forming with hexagonal packing is evaluated in terms of stress and strains distribution. The results demonstrated that forming tool with hexagonal packing is more efficient than pins arranged in square packing. But dimples and wrinkles as the typical defect of multipoint forming was inevitable consequences of discontinuous contact between the punches and workpiece, appeared. The dimpling phenomenon is more present in MPF with hexagonal packing than with square packing.

**Keywords:** *multipoint forming; packing density; hexagonal packing; numerical simulation*



**DESIGN**

**Modeling and Analysis of Hybrid Shock Absorber for Military Vehicle Suspension**

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**Abstract**―This paper deals with the design, modeling and analysis of a hybrid shock absorber for vehicle suspension. A specific design of frictional-electromagnetic-regenerative shock absorber is proposed. The hybrid shock absorber consists of the proposed frictional -electromagnetic-regenerative shock absorber assembled in parallel with a conventional-viscous shock absorber. The concept of hybrid shock absorber is proposed due to the following advantages: the regenerative shock absorber will recover some wasted vibration energy from the suspension into electrical energy to support the need for electrical energy of the vehicle, while the viscous shock absorber maintains the performance of suspension closed to its original suspension. The vehicle suspension system dynamic was mathematically modeled for three different types of suspension:1).Conventional suspension using viscous shock absorber; 2).Hybrid suspension using combination of 50% frictional-electromagnetic- regenerative shock absorberand50% viscous shock absorber; and 3).Full regenerative suspension using 100% frictional-electromagnetic-regenerative shock absorber. In this research, 6 wheels military vehicle (APC:Armour Personal Carrier) is chosen as the model due to the high possibility of applying regenerative suspension to the military/off road vehicle. Based on the mathematical models, performances of the vehicle suspension and the regenerated power from regenerative shock absorber (RSA) were simulated. The results were compared between the three types of suspension and discussed.

**Keywords:** *Hybrid suspension; regenerative shock absorber; regeneration of vibrational energy; vibration energy harvesting*

**Optimization Spring Coil Design for Orthodontic Tooth Movement**

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**Abstract**― Orthodontic tooth movement is achieved by the remodeling of alveolar bone in response to mechanical loading by using spring coil. Spring coil design was made of round stainless steel wire and usually it was custom- made design. In the previous study, the orthodontic force on 30 gram is required to move maxillary incisor during experimental tooth movement in rat. In this study, optimization new design of spring coil is developed to fulfill the requirement of orthodontic force. The design variable of new spring coil design is set on variation of angle aperture (5o ≤ α ≤ 10o), hook length (10 mm ≤ l ≤ 20 mm) and hook diameter (0.012 inch ≤ D ≤ 0.014 inch). From the result, it can be produced the optimum designs which 8.9o of angle aperture; 12 mm of hook length and 0.014 inch of hook diameter for fulfilling the requirement of orthodontic force on 30 gram force.

**Keywords*:*** *Optimum design; Spring Coil; Orthodontic*

**Thermal Stress Intensity Factors of Crack in Solid Oxide Fuel Cells**

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**Abstract**― Structural durability is the main focus of solid oxide fuel cells (SOFCs) development which is affected by the thermal stress caused by considerable CTE mismatch between components and thermal gradient. In this paper we investigate the thermal stress intensity factor for mode I, mode II and mode III of positive electrode- electrolyte-negative electrode (PEN) at room temperature and steady stage for an initial crack size of 10 µm. A commercial finite element analysis (FEA) was used to find the highly stressed regions in PENs and calculate the thermal stress intensity factors. The stress distributions are calculated at uniform room temperature and at steady stage with a non-uniform temperature profile. The thermal stress intensity factors are calculated for various principal directions at the location having the greatest maximum principal stress at room temperature and steady stage. The critical stress regions are identified based on the maximum principal stress at room temperature and steady stage. The maximum principal stress is of 53.45 MPa and 45.12 MPa in principal direction of -43.97o and -42.37o at room temperature and steady stage, respectively. The mixed-mode stress intensity factor including mode I, mode II, and mode III is is calculated due to multi-axial thermal stresses. However, the stress intensity factor for mode I have a highest value compared to those for modes II and III. The principal direction has an effect on the thermal stress intensity factor for the critical region with the greatest maximum principal stress. All the calculated stress intensity factors in the present study are less than the corresponding fracture toughness given in the literature, ensuring the structural integrity for the given planar SOFC stack.

**Keywords*:*** *PEN; Thermal Stress Intensity Factor; Principal Direction*

**Intelligent Bearing Diagnostics Using Wavelet Support Vector Machine**

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**Abstract**―This paper deals with implementation of intelligent system for fault diagnostics of rolling element bearing. In this work, the proposed intelligent system was basically created using support vector machine (SVM) due to its excellent performance in classification task. Moreover, SVM was modified by introducing wavelet function as kernel for mapping input data into feature space. Input data were vibration signals acquired from bearings through standard data acquisition process. Statistical features were then calculated from bearing signals, and extraction of salient features was conducted using component analysis. Results of fault diagnostics are shown by observing classification of bearing conditions which gives plausible accuracy in testing of the proposed system.

**Keywords*:*** *fault diagnostics; rolling element bearing; intelligent system; support vector machine; wavelet function*

**Degradation Trend Estimation and Prognosis of Large Low Speed Slewing Bearing**

**Lifetime**

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**Abstract**― In many applications, degradation of bearing conditions are usually monitored by changes in time- domain features, such as root mean squares (RMS), kurtosis, skewness, and entropy. However, in low speed (< 10 rpm) slewing bearing, these changes are not easily detected because of the low energy and low frequency of the vibration. To overcome this problem, a combined low pass filter (LPF) and adaptive line enhancer (ALE) signal pre-conditioning method is used. Three time-domain features are extracted from the output signal of the combined LPF and ALE method. These features provide more information about the incipient fault as compared to extracted features from the original vibration signal. This information then triggers the prognostic algorithm to predict the remaining lifetime of the bearing. The algorithm used to determine the trend of the non-stationary data is AutoRegressive Integrated Moving Average (ARIMA). The proposed algorithm provides an accurate degradation trend prediction of the bearing life for a slewing bearing case.

**Keywords**: *Adaptive line enhancer; Autoregressive integrated; moving average; Degradation trend; Prognostic analysis; Low speed slewing bearing*

**Electrical Energy from Vibration of a Washing Machine**

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**Abstract**― Piezoelectric materials can produce electricity when they are subjected to dynamic strain. In this paper, the development of a mechanism using a piezoelectric element for harvesting energy from a washing machine is reported. The device was in the form of a cantilever type transducer, using simple components. The main aim of the work is to give a practical implementation of the conversion of mechanical energy by using direct piezoelectric effect. Experimental results showed that, in average, the operation of the washing machine could generate 1.87 mV for a stainless steel cantilever beam and 1.46 mV for an aluminum cantilever beam.

**Keywords**: *VEH; piezoelectric; cantilever structure; washing machine*

**Modeling, Prototyping and Testing of Regenerative Electromagnetic Shock Absorber**

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**Abstract**―It is well fact known that automobiles are inefficient, wasting over 74% of energy stored in fuel as a heat. One important loss is the dissipation of vibration energy by shock absorbers in the vehicle suspension under the excitation of road irregularity and vehicle acceleration or deceleration. In this paper we design, characterize and test a regenerative electromagnetic shock absorber which can effectively recover the vibration from the road irregularity. Regeneration energy is main purpose of the design without omit vehicle comfort and handling. The dynamic model of the entire system of the electromagnetic shock absorber was proposed and described. The performance of the electric shock absorber obtained from simulations was compared toward the experiment results. Refers to the simulation, a quarter car will be able to harvest 45 Watt average power while passing C class roads with 50 km/h vehicle speed. A peak power of 45 Watt and average power of 11.43 Watt are attained from the prototype when oscillating speed of bench test at 0.1 m/s, the RMS value of suspension velocity when vehicle pass C class road with speed 50 km/h.

**Keywords:** *vehicle; vibration; harvesting; energy; shock; absorber; linear; electromagnetic; generator*

**Experimental Study of Vibration of Prototype Auditory Membrane**

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**Abstract**― This experiment report the vibration of Prototype Auditory Membrane (PAM) for a novel implantable auditory membrane. PAM made of PVDF which is fabricated using MEMS technology. The vibration are measured as a response of a pulse sine wave which are applied from one of side of the membrane. The vibrations are analyzed experimentally based on the Fourier analyze theory.

**Keywords:** *Auditory membrane; cochlea; PVDF; pulse; vibrations*

**Interaction between a Crack and an Isotropic Tri-Material Media in Anti-plane**

**Elasticity**

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**Abstract**― Solution of a crack interacting with a tri-material under a remote shear load for anti-plane elasticity problem is considered in this paper. The main purpose of this work is to study the interaction between a crack and a tri-material for anti-plane elasticity problem. This can be achieved by determination of the stress intensity factors that allow the characterization of this interaction from the point of view of linear elastic fracture mechanics. The proposed method is based on complex variable solution of a screw dislocation together with logarithmic singular integral equations. The singular integral equation is then solved numerically by modeling a crack in place of several segments. Some numerical results are performed to show the effects of material property combinations and geometric parameters on the normalized mode-III stress intensity factors. The results show that the stiffer materials may always give retardation effect on stress intensity factors when a crack approaching interfaces. On the other hand, the softer materials may always give enhancement effect on stress intensity factors.

**Keywords:** *a crack interacting with a tri-material; screw dislocation; logarithmic singular integral equation;*

*mode-III stress intensity factors*

**Split Bar Hopkinson with Springs Striker Bar Launcher**

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**Abstract**―Research on the dynamic strength of various materials such as metallic materials, polymers, concrete has been done by many researchers. The Split Hopkinson Bar method is still used to produce a high strain rate. In this method, a striker bar is usually launched using pressurized gas. However, high security system is required to prevent leakage as the operating pressure is very high. Avoiding the use of high-pressure gas, in this study, a mechanical system of springs used to propel the Striker Bar. By varying the spring deflection of 1 cm to 8 cm, a linear Striker Bar velocity from 2.17 m/s until 19.45 m/s is obtained. Aluminum alloy Al-2024 has been tested with this tool and it is found that at the maximum Striker Bar velocity, strain rate on the material can be reach

1132 s-1, and dynamic compression yield strength increase 56% from quasi-static compression yield strength.

**Keywords:** *strain rate; hopkinson bar; dynamic strength*

**Numerical Study of Salat Movements for Total Hip Replacement Patient**

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**Abstract**― Salat as a daily Muslim activitiy in praying contains several movements which are not suggested by orthopaedic doctor to be conducted by patient with total hip replacement (THR). Sujud and sitting are two movements in Salat which is recommended to be done above the chair for THR patients. There are lacks of scientific discussions about the consequences of the normal salat movement for Muslim THR patients. This paper observes the effect of these movements to the artificial hip joint in THR patient body. A three-dimensional finite element simulation is used to investigate the resisting moment, the contact pressure and the von Mises stress. An artificial hip joint model proposed by previous researcher is used in the simulations. The results show that sujud induces the impingement and plastic deformation whereas sitting is relatively safe to be conducted by THR patients. Some suggestions are also discussed with respect to the design of new artificial hip joint model which allows THR patients to conduct Salat in a normal way. The reduction of inset at the liner, the new profile at circumferential edge inner liner and the increase in the femoral head diameter can be considered as a guideline for new design of the artificial hip joint for Muslim.

**Keywords:** *Salat Movement; Artificial Hip Joint; Total Hip Replacement; Impingement*

**Structural Analysis of a Tracking Photovoltaic System with a Pedestal Solar Tracker**

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**Abstract**― The structural integrity and deformation-induced misalignment of solar radiation for a tracking photovoltaic (PV) system under self-weight is investigated using a finite element analysis (FEA) approach. Gravity is applied to calculate the stress distribution and structural deformation. Misalignment of solar radiation induced by structural deformation is also calculated. Moreover, to avoid damages caused by resonance, natural frequencies of vibration for the given tracking PV system are also determined. Strain changes are measured experimentally at two selected locations in the given solar tracker during field operation for comparison with the simulation results. A reasonable agreement between the simulations and experimental measurements is found such that the constructed FEA model is validated to be effective in assessment of the structural integrity for PV systems under self-weight. No structural failure is predicted for all components in the given solar tracker under the given loading condition according to the von Mises failure criterion. An agreement in the trend of variation of misalignment and resultant displacement of PV modules is found. Considering the effect of self-weight only, the maximum misalignment of solar radiation is of 0.275o at elevation angle of 45o when rotating the solar tracker from 0o to 75o. It is expected that such a misalignment value will not cause a significant degradation of power generation for a PV system. The range of natural frequencies of the first six vibration modes for the given PV system is from 3.85 Hz to 11.4 Hz.

**Keywords:** *photovoltaic system; solar tracker; structural deformation; natural frequency*

**Numerical Modelling of the Initial Stress and upward deflection of Glulam Beams**

**Pre-stresseed by Compressed Wood**

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**Abstract**― A new approach to reinforce glulam timber beams has been developed by using compressed wood (CW) which is made of a lower grade wood through densification processes. In the reinforcing practice, compressed wood blocks are inserted into pre-cut holes on the top of glulam beams to produce pre-camber and to generate initial tensile and compressive stresses on the top and the bottom extreme fibre of the glulam beam. In order to optimize the size, the number and the location of CW blocks, 3-D finite element models have been developed. 3D non-linear finite element models have been developed to simulate the pre-camber of Glulam beams locally reinforced by compressed wood blocks. The models developed have also produced the initial tensile and compressive stresses at the top and bottom extreme fibres with building-up moisture-dependent swelling on the CW blocks. With the pre- camber and the initial stress state that cancel out proportions of working deflection and stresses.

**Keywords:** *finite element; glulam beam; compressed wood; pre-camber; initial stress*

**Physiological Concept: Visible Modeling for Feasible Design**

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**Abstract**― Conceptual design plays an important role in design stage as an initiation to interpret an abstract idea into a design concept. However, conceptual modeling in previous engineering designs provided premature detailed modeling. Such methodologies delivered almost pure quantitative techniques to do the modeling, which have made it difficult to do agile design process for specific-purposed products. Such products require unique approach for each situation. This paper proposes physiological concept modeling to overcome such phenomenon by combining process and functional modeling with qualitative interpretation. Physiological modeling incorporates derivation to transform idea into a design concept with almost no quantitative postulates. A case study on competition-based electric car is also provided to show an overview of application. The study concludes that there are seven steps required to do physiological modeling. The derivation can also bring flexibility for dynamic or continuous system by introducing cyclical & dynamic relationship between processes, including interventions from outside observed system and function of residue to accommodate side residues. By looking at previous techniques, this study brings a new light to produce design concept which is feasible but can be visibly modeled even by novice designers.

**Keywords:** *conceptual design; physiological concept; functional modeling; process modeling; qualitative approach;*

*electric car*

**Trailing Edge Deformation Mechanism for Active Variable - Camber Wind Turbine**

**Blade**

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**Abstract**― Blade root fatigue stress, primarily resulting from wind shear and turbulence, is a critical factor in wind turbine design. Blade mounted aerodynamic control devices have been shown to have the potential to reduce this. However, limited research exists into suitable devices, with great challenges being involved in meeting the requirements for use on large turbines. The blade designed in this work addresses this by employing a piezoceramic actuated compliant mechanism, contained within a flexible matrix composite structure. The resulting mechanism design achieves a sectional change in lift coefficient of ΔCL +0.4 to −0.15. The performance of the blade is analysed with a quasi-steady time marching BEM model, employing optimal control. A reduction of 21.59% in the standard deviation of the flap-wise bending moment was achieved, a comparable result to previous load control investigations.

**Keywords:** *airfoil; compliant mechanism; load control; variable-camber; wind turbine*

**FEA Study of a Land Speed Record Motorcycle Chassis**

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**Abstract**― The aim of this report is to model, simulate and perform stress analysis on a chassis under current development for a motorcycle streamliner which is being manufactured with the target being the world's fastest motorcycle. Within this report, the details of the computer modeling and simulation set-up shall be explained, while an variety of simulated situations shall be analyzed.

**Keywords:** *FEA; Finite Element Analysis; Land Speed Record; Motorcycle; Bike; Streamliner; Streamlining; Stress; CAD Model; Simulation*

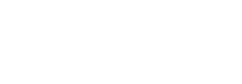
**Modular system for testing the performance of poly-articulate robotic structures**

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**Abstract**― This paper presents a modular system for testing the performance of a poly-articulate robotic arm (snake like) with the push-pull actuation redundancy. Mechanical structure contains modules that allow testing of robots with different structures of the robotic arm (discrete hyper-redundant, continuous). Sensory system can be configured depending on the product and testing program adapting the sensors of position, velocity, time and vibrations. The monitoring system developed allows the automatic calibration of actuators and sensors, data and signal acquisition.

**Keywords:** *robotic structures; stand modules; assisted testing*

**Preliminary Numerical Study on Designing Navigation and Stability Control**



**Systems for ITS AUV**

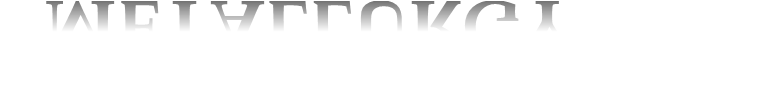
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**Abstract**― In this paper, the numerical study of designing on navigation and stability control system for AUV is studied. The study started by initiating hydrostatic forces, added masses, lift force, drag forces and thrust forces. Determining the hydrodynamic force which is the basic need to know the numerical case study on designing on navigation and stability control system for AUV where Autonomous Underwater vehicles (AUV). AUV is capably underwater vehicle in moving automatically without direct control by humans according to the trajectory. The result of numerical study is properly to be the reference for the next developing for AUV.

**Keywords:** *AUV; Numerical study; Hydrodynamic force; navigation; Stability; control System*



**METALLURGY**

**Assessing the Friction and Abrasion of Paddy Straw / Cockle Fibres Reinforced**

**Polymer in Lubricated/Dry Sliding Condition**

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**Abstract**―Utilising natural fibre as reinforcing materials has explosively give impact to society as consumer nowadays are concern about recycling and reutilizing natural element in comparison to synthetics. Hence, scientists and engineers prefer to address naturally decomposed material hybrid polymer to enhance its mechanical strength, lowering cost yet integrate its reparability, flexibility and durability. Polymer matrix can be easily applied and repaired to gain back its design structure by appropriate calculation and systematic process. Therefore, many successful structure applications with certain specification and theme can be designed using natural resources. In this study, lubricated and dry sliding condition of natural fibre reinforced polymer was monitored. Mechanical and tribological characteristic was studied. Paddy straw and cockle fibre used show better tribological performance compared with pure polypropylene. Wear rate was reduced by at least two folds compared to pure polypropylene. The presence of lubricant in the research shows a reduction in frictional forces by at least

10% in comparison to dried abrasion. Worn surface morphology was observed using SEM.

**Keywords:** *Lubricated abrasion; paddy straws; cockle shell; composites; wear; frictional force*

**Effect of Tool Tilt Angle and Tool Plunge Depth on Mechanical Properties of**

**Friction Stir Welded AA 5083 Joints**

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**Abstract**― The influences of tool tilt angle and tool plunge depth on tensile properties of friction stir welded AA

5083-H116 with the thickness of 4 mm were studied. Four different values of tool tilt angle of 1° 2°, 3°, and 4° were used to fabricate the joints. The tool plunge depth was choosen 3.85 mm, 3.90 mm and 3.95 mm. The FSW rotational speed and welding speed were 1125 rpm and 30 mm/min, respectively. The temperature,

macrostructure, hardness and tensile strength of joints were compared and discussed. Results show that the increase of tool tilt angle and tool plunge depth resulted the welding temperature increase. Due to the increase of welding temperature, the hole defect become smaller. Tensile testing results indicated that the tensile strength

of joints increased with increasing both the tool tilt angle and tool plunge depth.

**Keywords:** *Friction stir welding; AA 5083; Tool tilt angle; Tool plunge depth; Mechanical properties*

**Synthesis Of Zinc Oxide Nanoparticles By Self Combustion Technique**

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**Abstract**― Zinc oxide (ZnO) is a unique material which has been used in many researches. However synthesizing nanosize ZnO remains a challenge. This deals with the preparation of ZnO nanoparticles was synthesized by a self combustion technique. In the self combustion technique, nanoparticles was obtained by heating the materials until the mixture combusts at 110oC. ZnO nanoparticles were synthesized from Zn(NO3)2.6H2O precursor observed in two different solvent. The first set of experiment involved dissolving Zn(NO3)2.6H2O in nitric acid (HNO3) and adding ZnO, whereas for the second Ethylene Glycol (C2H6O2) was used as the solvent. The material was stirred at 250 r.p.m continuously for 1 month and 3 days. The mixture was then heated up until it combusted at 110oC. Samples were then annealed at 400oC for 1 hour . The ZnO samples were characterized using X-Ray Diffraction (XRD), Raman Spectroscopy, and Field Emission Scanning Electron Microscope (FESEM). The XRD analysis showed major peak at 20-30 of 2 theta scale with [100], [002], and [101] plane of the wurtzite hexagonal structure for both sets of ZnO samples. Samples were observed at raman shift for 138 and 439 cm-1 and 141 and

443 cm-1 before and after annealing. Synthesized ZnO 1 resulted the morphology of single crystal nanorods with average dimensions of 18 nm wide and 154 nm long. ZnO 2 has obtained the morphology of single crystal nanosphere with average diameter of 30 nm.

**Keywords:** *Zinc Oxide; Ethylene Glycol; Self Combustion Technique*

**Effect of Ingredients on Flexural Strength of Friction Composite**

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**Abstract**― In the present work, a friction composite material which will be used for material of train brake shoe was investigated to study the effect of ingredients on flexural strength. The Taguchi method was used to measure relative effect of ingredients on flexural strength of composite. Taguchi L8 orthogonal array which consists of 7 factors with 2 levels each was applied to perform experiment. Ingredients of friction composite were considered as factors or parameters and % volume for each factor was varied at 2 levels. Phenolic resin and barite (BaSO4) were not included as factor. Phenolic resin was always kept constant at 30 % volume and % volume of barite (BaSO4) was varied to compensate the changing of other ingredients amount. The results show that glass fiber and cast iron chip have significant effect on increasing of flexural strength of brake shoe composite. Conversely, NBR has significant effect on decreasing of flexural strength of brake shoe material. Cashew dust, Cu short wire, fly ash and graphite have insignificant effect on flexural strength. Cu short wire can’t play a role as reinforcement fiber in brake shoe composite because there is weak bonding between Cu short wire and matrix.

**Keywords:** *Flexural strength; Brake shoe composite; The Taguchi method*

**Dielectric Properties for the Ring Opening Polymerisation of ε-Caprolactone**

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**Abstract**― A dielectric property study was performed across a wide range of frequencies and temperatures on ring opening polymerisation of ε-caprolactone system in order to relate quantitatively their dielectric properties to microwave heating mechanisms. An analysis of the results concluded that heating mechanism of the polymerisation mixtures in a microwave field was controlled by the dielectric properties of monomer, where the monomer was the major component (>90 % volume/volume) as well as the component with highest dielectric loss and dissipation factor. The penetration depth of mixtures at 2.45 GHz was noted to increase from ~0.58 cm (at 20

°C) to ~3.3 cm (at 150 °C). This small penetration depth limits the potential to achieve the successful scale up of a microwave-assisted polymerisation of ε-caprolactone in batch mode at 2.45 GHz. As a result, this will lead to inhomogeneous bulk temperature distribution within the polymerisation mixture and irreproducible chemistry. However, a fast heating rate based on a high value of dissipation factor and dielectric loss of the polymerisation mixtures shows potential to enable the reaction to be completed in a few seconds that may allow the polymerisation to be transferred to a continuous flow process. In so doing, small diameter tubular reactors can be employed hence removing this penetration depth issue. Thus, the polymerisation mixtures dielectric properties are worth to be considered to ensure the reliability and reproducibility of the microwave assisted synthesis of poly-ε-caprolactone at large scale production.

**Keywords:** *Dielectric properties; Relaxation time; Penetration depth; Microwave assisted polymerization; Polymerisation of biodegradable polymer*

**P-h Curves and Hardness Value Prediction for Spherical Indentation Based on the**

**Representative Stress Approach**

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**Abstract**―In this work, finite element (FE) model of spherical indentation has been developed and validated. The relationships between constitutive materials parameters (sy and n) of elastic-plastic materials, indentation P-h curves and hardness on spherical indenters has been systematically investigated by combining representative stress analysis and FE modelling using steel as a typical model material group. Parametric FE models of spherical indentation have been developed. Two new approaches to characterize the P-h curves of spherical indentation have been developed and evaluated. Both approaches were proven to be adequate and effective in predicting indentation P-h curves. The concept and methodology developed is to be used to predict Rockwell hardness value of materials through direct analysis and validated with experimental data on selected sample of steels. The Hardness predicted are compared with the experimental data and showed a good agreement. The approaches established was successfully used to produce hardness values of a wide range of material properties, which is then used to establish the relationship between the hardness values with representative stress.

**Keywords:** *Spherical Indentation; Rockwell Hardness value; Representative stress; P-h curve; FE model*

**Simple Recipe to Synthesize BaTiO3-BaFe12O19 Nanocomposite Bulk System with**

**High Magnetization**

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**Abstract**―In this work, finite element (FE) model of spherical indentation has been developed and validated. The relationships between constitutive materials parameters (sy and n) of elastic-plastic materials, indentation P-h curves and hardness on spherical indenters has been systematically investigated by combining re Barium titanate BaTiO3 (BTO) - barium hexaferrite BaFe12O19 (BHF) nanocomposite could be as a raw material of multiferroic. Multiferroic is a class of materials with coupled electric, magnetic and structural order parameters that yield simultaneous effects of ferroelectric, ferromagnetism and ferroelasticity in the same material. This material has potential applications in such as spintronic devices and sensors. This work was an earlier research towards formation of multiferroic material. Knowing magnetic properties that will lead to a better understanding of magnetoelectric coupling in multiferroic material is the objective of this research.The samples were BTO and BHF prepared by sol-gel and then were mixed to synthesize composite in bulk system by a conventional techniques in various of weight fraction between BTO : BHF = 1:1 ; 1:2 and 1:3, then samples were sintered at 925oC for 5, 10 and 15 hours for each fraction respectively. Composite phase study was carried out using X-Ray Diffraction (XRD). MPS Magnet – Physik EP3 – Permagraph L was used to characterize magnetic properties. No residual phases were identified in the XRD analysis for all parameters. The peaks can be only indexed to BaTiO3 and BaFe12O19 phases for all parameters respectively confirming the formation of a BaTiO3-BaFe12O19 composite system. Barium titanate retains its tetragonal structure while barium hexaferrite exhibits hexagonal structure. For weight fraction of BaFe12O19 until 2 parts there is an increase of intrinsic coersive and saturation magnetization value. The maximum values of intrinsic coersive for samples with 5, 10 and 15 hours sintering are of 361.3 kA/m,

359.0 kA/m and 391.6 kA/m respectively and the maximum values of saturation are of 0.1515 T, 0.1516 T and

0.1414 T respectively leading to good characteristics of multiferroic materials.

presentative stress analysis and FE modelling using steel as a typical model material group. Parametric FE

models of spherical indentation have been developed. Two new approaches to characterize the P-h curves of spherical indentation have been developed and evaluated. Both approaches were proven to be adequate and effective in predicting indentation P-h curves. The concept and methodology developed is to be used to predict Rockwell hardness value of materials through direct analysis and validated with experimental data on selected sample of steels. The Hardness predicted are compared with the experimental data and showed a good agreement. The approaches established was successfully used to produce hardness values of a wide range of material properties, which is then used to establish the relationship between the hardness values with representative stress.

**Keywords:** *sol-gel; nanocomposite; magnetic properties; multiferroic material; weight fraction*

**Analysis of Fiber glass/Vinyl ester Composite Subjected to Internal Pressure Loading for Compressed Natural Gas (CNG) Tube Type IV Application**

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**Abstract**―Natural gas in the form of compressed natural gas (CNG) has a pressure of 20 MPa. Glass fiber/vinyl ester composite has potential to be formed into a CNG tube. This study uses a numerical analysis method to assess the composite’s ability to withstand internal pressure according to Hill failure criteria. Some mechanical properties of the composite were obtained from tensile test of composite with fiber direction of 0o, 45o, and 90o. The fiber direction and suitable number of layers were evaluated. It was found that the combination of large and small winding angles of (±70, ±25) provided more optimal result than using a single angle. Still, the composite is deemed unsuitable as the material of CNG tube type IV.

**Keywords:** *Compressed Natural Gas; Composite; Fiber Glass; Numerical Analysis; Vinyl-Ester*

**Effect of intercritical annealing temperature and holding time on microstructure and mechanical properties of dual phase low carbon steel**

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**Abstract**― Dual phase steels are an important advanced high strength steel, which have been widely used in the automotive industry for vehicle components requiring light weight and safety. In this study, the formation of dual phase structure with various martensite volume fraction in a low carbon steel SS400 during intercritical annealing were investigated. It was found that intercritical annealing temperature and holding time affected the microstructure and mechanical properties of dual phase low carbon steel. The specimens were heated at intercritical annealing temperature of 750oC, 775oC, 800oC and 825oC, for holding periods of 6-18 minutes, followed by water quenching in order to get a dual phase ferrite and martensite. Actual results of steel that could achieve good strength–ductility balance are also presented. Making the dual-phase steel structure composed of ferrite and martensite were both effective to manage high strength and large uniform elongation. After quenching, it was obtained the optimal annealing conditions (martensite volume fraction approaching 20%) at 800oC with a holding periods of 10 minutes. The relationship between temperature and time of intercritical annealing and martensite volume fraction showed that a equation as fg/fe = 1 - exp(-Ktn) can be used to give variation of martensite volume fraction with heating temperature and time. Also it is found that K coefﬁcient changes exponentially with annealing temperature. In addition, the value of K (grain growth rate constant) and n (Avrami’s exponent) were 0.263 and 0.318, respectively, with activation energy (Q) of 30,4 kJ/mol.

**Keywords:** *Dual phase steel; martensite volume fraction; ferrite; intercritical annealing; K coefﬁcient*

**The Influence of High Content of Silicon in Austenitic Stainless Steel to Corrosion**

**Rate in Sulphuric Acid**

Femiana Gapsari, Slamet Wahyudi and Sumawan Alfadh *Brawijaya University,Indonesia* [femianagapsari@gmail.com](mailto:femianagapsari@gmail.com)

**Abstract**― This study is aimed at investigating the performance of saramet compared to other austenitic stainless steel (SS) types. Saramet is a type of austenitic SS which contains Silicon (Si) higher than others. The research treatment was divided into 2 activities which were at room temperature and high temperature. The material used were saramet, SS 304 and SS 316L. Corrosion test was conducted by using weight losing method and electrochemical. The findings show that saramet is more resistant to corrosion compared to SS 304 and SS

316L both at high and room temperature. Saramet has better performance at high temperature

**Keywords:** *silicon; saramet; autenitic stainless steel; sulfuric acid; corrosion rate*

**Optimization of Chemical Environment Condition towards Corrosion Rate of Sulfuric Acid Resistant Alloy Metal (Saramet) using Response Surface Methodhology**

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**Abstract**―This study investigates the variation of sulphuric acid concentration, temperature, and time towards the corrosion rate of saramet using response surfacemethod. Method used in this study is true experimental research. Sarametis material which is included into type of austenitic stainless steel which contains high amount of silicon. Starting at these past 2 years, the material has been widely used.This research used weight loss method. It has been found that minimum corrosion rate is achieved at concentration combination of 89.49% in 3.682 hoursandat temperature of 106,8 °C. From the variation combination, it is seen that the low concentration will decrease ion mobility– corrossive ion from saramet.The long period of exposure supports the forming of passive layer which prevent the corrosive ions gets into the steel surface. As a result, corrosion rate decreases. At high temperature, steel which has high silicon content will be stable in terms of its atomic bound which therefore makes it posses high corrosion resistance.

**Keyword: *s****corrosion rate; response surface methodology; saramet; optimization*

**Effects of High Speed Tool Rotation in Micro Friction Stir Spot Welding of**

**Aluminum A1100**

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**Abstract**― Technology of Friction Stir Welding (FSW) is a relatively new technique for joining metal. In some cases on Aluminum joining, FSW gives better results compared with the arc welding processes, including the quality of welds and less distortion. The purpose of this study is to analyze the parameters effect of high speed tool rotation on micro Friction Stir Spot Welding (µFSSW) to the shear strength of welds. In this case, Aluminum material A1100, with thickness of 0.4 mm was used. Tool material of HSS material was shaped with micro grinding process. The spindle speed was fixed at 30000 rpm. Tool shoulder diameter was 3 mm, and a length of pin was 0.7 mm. The parameter variations used in this study were the variable of pin diameter (1.5 mm, 2.0 mm, and 2.5 mm), a variable of plunge speed (2 mm/min, 4 mm/min, 6 mm/min), and the variable of dwell time (2 seconds, 4 seconds, 6 seconds). Where the variation of these parameters will affect to the mechanical properties of welds (as response) was the shear strength. Response Surface Methods (RSM) was used to analyze µFSSW parameters with the shear strength of welds. From the result of experiment and analysis, it is shown that the important welding parameters in high speed µFSSW process are pin diameter and plunge speed.

**Keyword:** *micro Friction Stir Spot Welding; Thin plate; Aluminum A1100; Response Surface Methods*

**Hydrophobic Silica Coating Based on Waterglass on Copper by Electrophoretic**

**Depositon**

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**Abstract**― Hydrophobic silica coating on copper (Cu) were prepared by electrophoresis deposition (EPD) method. This paper examined the effect of voltage, the addition of TMCS, EPD time, and silica sol concentration. The hydrofobic silica was observed by contact angle of droplet water on coating film surface. SEM images showed surface condition of silica coating. TMCS concentration had a great influence in forming hydrophobic silica coating on Cu, but needed more control because of its reaction with water and hydroxyl group. The biggest resulted hydrophobic Cu have contact angle 130o. The higher voltage and silica sol concentration can form silica coating more hydrophobic. This also occured for EPD time varied.

**Keyword:** *hydrophobic copper; Trimethylchlorosilane (TMCS); EPD; silica sol*

**Comparison of AISI 316L Plasma Nitriding Behavior at Low and Medium**

**Temperature**

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**Abstract**―Plasma nitriding is a widely used technique to improve the mechanical properties and tribological properties of AISI 316L steel because it has many advantages over other surface treatment techniques. One of this advantage is plasma nitriding allows nitrogen diffuse into steel at low temperature (below 500oC).

In this study, nitriding of an AISI 316L was performed in high density plasma nitriding system using

70%N2:30%H2 gas mixture at 400oC and 480oC for 2, 4, and 8 hours. Optical Emission Spectroscopy with optical probe was used for plasma diagnosis. The properties of nitrided sample were investigated through micro hardness

measurement. The results show that N2 ions and radicals are species predominantly formed in plasma. The nitriding process took place in shorter time with the nitriding rate three times higher than the conventional DC plasma nitriding processes at medium temperature. Nitriding rate, maximum surface hardness, and nitrided

layer thickness increase with increasing of nitriding temperature and nitriding times.

**Keywords:** *nitriding; austenitic stainless steel; surface; reatment; nitriding rate; high dense plasma*

**Na2SO4 Induced Hot Corrosion of Aluminized Low Carbon Steel at 700 C**

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**Abstract**― The oxidation kinetics of hot-dip aluminized AISI 1020 steel with Na2SO4 deposit was investigated at 700 °C for 49 h in static air. The corrosion products were characterized by means of metallograpy, scanning electron miscroscopy (SEM), electron dispersive spectroscopy (EDS) and X-ray analyses. The accelerated oxidation of aluminized steel was attributed by forming of aluminum-sulphides. The Al-sulphides in the alumina scale cause the Al-depletion so Al2O3 layer fails to form a protective layer and allows the rapid diffusion of Fe ions in the aluminide layer to form iron oxide. Thus, the kinetics rate of aluminized steel was increased.

**Keywords:** *Aluminized AISI 1020 steel; hot-corrosion; Na2SO4 deposit; Al-sulphides; protective Al2O3*

**Effect of Starter Defect to GIIC of Unidirectional CFRP Composite**

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**Abstract**―Critical strain energy release rate in CFRP composites characterizes the delamination resistance. More study is still needed to measure the critical strain energy release rate in sliding shear mode (GIIC) considering various factors that influence its measurement. This study evaluates one of the influencing factors, the starter defect. Two types of on thin, unidirectional CFRP composites with one having thin film insert as starter defect and another one with pre-crack under Mode II loading were prepared and tested in three point bending end notch flexure (3ENF) test. It was found that the (GIIC) of the former was more than twice higher than that of the latter, supposedly due to the presence of resin rich region in the former.

**Keywords:** *CFRP; End Notch Flexure; Delamination; Energy Release Rate*

**Acoustic Emission Hit Generation Behavior of Basalt Fiber High Strength Mortar under Compression**

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**Abstract**―Acoustic emission (AE) has been applied to study the fracture mechanics of concrete and other cementitious materials. This paper aims to investigate the characteristics of high strength mortar containing basalt fiber using AE under compression. A variety of amount and length of basalt fiber were used in mortar mix. There is no significant effect observed on behavior of AE hit generation due to the differences amount and length of basalt fiber in mortar. In all specimens, nucleation of cracks was detected before maximum stress occur, however all indicate ductile failure since AE activities still can be recorded long after post peak behaviour.

**Keywords:** *acoustic emission hit; basalt fiber; high strength mortar; compression*

**Application of Myrmecodia Pendans Extract as a Green Corrosion Inhibitor for Mild**

**Steel in 3.5% NaCl solution**

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**Abstract**― The use of Myrmecodia Pendans (MP) extract as mild steel corrosion inhibitor in 3.5% NaCl media was investigated using weight loss and potentiodynamic polarization methods as well as characteristics analysis of the Fourier Transform Infra-Red (FTIR). Obtained data from weight loss and potentiodynamic polarization methods has shown the value of inhibition efficiency (% IE) is proportional toadded inhibitor concentration. Tafel constants data indicates that MP extract can act as cathodic and anodic inhibitors (type of mixed inhibitor). FTIR analysis also demonstrates the characteristics of MPextract. Occured inhibition mechanism was in the form of inhibitor adsorption process on metal surfacethat allegedly preceded by physical adsorption followed by chemical adsorption. Chemical adsorption is conceivable since metal surface scoping elevates as the increasing of inhibitor concentration.

**Keywords:** *inhibitor; Myrmecodiapendans; mildsteel*

**Al2O3 – SiO2 Coating By Flame Spray For Thermal Barrier Coating Application**

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**Abstract**― Nozzle is one crucial part of rocket. In this research, the nozzle was made by AISI 4340which coated by termal barrier coating (TBC). The TBC material is Al2O3–SiO2 composite. Composition variation of composite were 80% Al2O3 – 20% SiO2 ; 70% Al2O3 – 30% SiO2 ; and 60% Al2O3 – 40% SiO2. Mullite is an expected phase which formed from composite. This phase has thermal resistance during 1300oC. Coating process was conducted by flame spray with variation of plies. The effect ratio, plies, microstructure, phase, and adhesive strength of TBC were investigated using Scanning Electron Microscope (SEM), X-ray diffraction (XRD),) and adhesion testing. The results showed that the highest adhesive strength was 16 MPa for 20%SiO2with 2 plies. The highest mullite forming was TBC. After heat treatment, the mullite phase most widely formed at a composition of TBC 30% SiO2-

70% Al2O3.

**Keywords:** *Nozzle; AISI 4340; Al2O3 – SiO2; Flame Spray*

**Sintering of Stainless Steel Nanopowders for Micro-component Part Applications**

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**Abstract**― Micro Metal Injection Molding utilizing 316 steel nanopowder with 100 nm in mean size was investigated to fabricate micro part. The nanopowder was used since its advantages to produce better surface roughness and detail structure in the micro part fabrication. During nanopowder preparation, thin oxide must be formed intentionally to avoid powder burnt before it’s exposed to the air during mixing with the wax binder system. Unfortunately, this oxide still exist after sintering and decrease the mechanical properties (ductility and densification) by the formation of secondary phase which detected as chrome oxide. In this paper, deep elaboration for oxide characteristics and the ways to reduce it by vary the sintering parameters and in Hydrogen atmosphere were described briefly. Here, we infer by reducing the heating rate, increasing the sintering temperature and utilizing the Hydrogen atmosphere can be effectively optimize the utilizing of nanopowder for micro part fabrication.

**Keywords:** *Sintering; Stainless steel nanopowders; Micro-component*

**Effect of Electron Beam Irradiation on Mechanical and Thermal Properties of**

**Ethylene Vinyl Acetate/Polyamide 6/High Density Polyethylene Nanocomposites**

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**Abstract**―The effect of electron beam irradiation on mechanical properties of Ethylene vinyl acetate (EVA) with polyamide 6/high density polyethylene/HDPE-g-MAH and montmorillonite (MMT) were prepared by melt blending and the characterization were investigated in order to enhance mechanical and thermal properties of the samples. The composites were characterized by Fourier Transform Infrared (FTIR) spectrophotometer and Thermogravimetric Analyzer (TGA). The samples were cross-linked by electron beam and irradiated at the dosage range of 0-200 kGy and 3.0 MeV. The mechanical properties of the samples which are tensile test and flexural test were measured by universal tensile machine whiles hardness was measured using the Zwick Roell hardness tester. The gel content was performed to determine the formation of cross linking and it showed improvement with increase dose up to 150 kGy. The result shows the increasing of tensile strength, tensile modulus, and hardness at the dosage 150 kGy but slightly decline at doses up to 200 kGy. Meanwhile TGA test showed that both irradiated and unirradiated samples have same trend characterization but irradiated samples are slightly more thermal stabled. As a conclusion, the electron beam irradiation enhances mechanical and thermal properties of ethylene vinyl acetate/polyamide 6/high density polyethylene nanocomposite.

**Keywords:** *EVA Impact modifier; HDPE-g-MAH compatibilizer; mechanical properties; rubber toughened;*

*irradiation*

**Sol-Gel Synthesis of Zn doped HA Powders and their Conversion to Porous Bodies**

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**Abstract**― The present study was aimed at fabricating porous ceramic scaffolds via polymeric sponge method for biomedical applications using as synthesized Zinc doped Hydroxyapatite (ZnHA) powders. Zn doped HA powders were prepared via sol-gel method using diammonia hydrogen phosphate [(NH4)2HPO4] and calcium nitrate tetrahydrate [Ca(NO3)2.4H2O] as starting materials. The obtained powders were then used for the preparation of porous ZnHA scaffolds via polymeric sponge method. The green porous bodies so developed by impregnating cellulosic sponges with HA slurries, were subjected to sintering process at a temperature of 1300 °C. Field- emission scanning electron microscopy (FESEM) was used to observe the surface morphology of the powder and sintered porous sample. The structure and crystallinity of (Zn)HA powder and the sintered porous samples was analyzed using X-ray diffractometer whereas Fourier transform infrared spectroscopy (FTIR) was used to determine the presence of various phases in the powder. FESEM results showed the formation of agglomerates at an increased Zn concentration. The morphology of the porous samples showed high degree of fusion and densification with an increase in Zn concentration. Preliminary mechanical testing results show that maximum compression strength of HA porous bodies was 0.12 MPa.

**Keywords:** *Zinc doping; Hydroxyapatite; β-tricalcium phosphate; sol-gel method; polymeric-sponge method;*

*porous ceramics; characterization*

**Synthesis of Magnetite Nanoparticles by Hydrothermal Process**

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**Abstract**― Fe3O4 (magnetite) nanoparticles have become an interesting topic for scientist base on its application in many technological applications such as magnetic storage media, biosensing applications, medical applications, such as targeted drug delivery, contrast agents in magnetic resonance imaging (MRI), and magnetic inks for jet printing. Many studies showed that it was important to find a specific process to control the producing of magnetite nanoparticle on the size and the shape as needed. There are few reports on the producing of magnetite nanoparticles by hydrothermal synthesis using various temperatures and reaction times. Most of them used the reaction time more than 12 h to produce magnetite nanoparticles with the temperature below 200oC. Due to the case, the present research aims to synthesize Fe3O4 (magnetite) nanoparticles with hydrothermal process and analyzing the effect of the temperature, reaction time, and presence of Argon (Ar) gas on the formation of the magnetite nanoparticles. The characterization of the nanoparticles was also examined. This research used Fe3O4.7H2O as the iron source, ammonia for the base, and H2O2 as the oxidant. The result showed that the larger and more agglomerated nanoparticles obtained at longer reaction time. The increase in temperature resulted in the smaller nanoparticles and the more equilibrium particle shape with the euhedral shape (octahedron). The addition of Ar gas prior to the reaction also yielded the smaller nanoparticles.

**Keywords:** *Magnetite Particle; Fe3O4; Hydrothermal; nanoparticles*

**Preliminary Study of Development of HDPE/EVA/MMT/EFB Nanohybrid**

**Biocomposte by Using Single Screw Extruder**

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**Abstract**― This work study the mechanical properties (tensile, flexural and impact) of four different formulation of HDPE/EVA/MMT nanocomposite with present of 1.5 phr compatibilizer as a preliminary study before further development of HDPE/EVA/MMT/EFB nanohybrid biocomposite. The ethylene vinyl acetate (EVA) was varied from 0, 10, 20 and 30 wt%. Meanwhile the nanoclay montmorillonite (MMT) was varied from 0, 0.5, 1.0, 1.5, 2.0,

2.5 and 3.0 phr. HDPE/EVA/MMT ternary blends were prepared by melt extrusion blending technique using a single screw extruder. The result found that in absent of nanoclay MMT, the tensile and flexural properties

(strength and modulus) of HDPE/EVA/1.5 phr compatibilizer were decreased as EVA amount are increased. Meanwhile in absent of EVA gave the highest tensile and flexural strength which are 38.53 MPa and 35.02 MPa respectively. However the trend is reciprocal for impact strength. The Izod impact test found that 30 wt% EVA

give the highest impact strength which is 103.88 J/m , followed by 20 wt% EVA, 10wt % EVA and 0 wt% EVA which are 59.91 J/m, 38.11 J/m and 30.63 J/m respectively. Meanwhile incorporation of nanoclay MMT improved the tensile and flexural properties but reducing the impact properties.

**Keywords:** *Single screw extruder; nanohybrid biocomposite; natural fiber; mechanical properties*

**Microstructure Study On Fe/Cr Based Alloys Added With Yttrium Oxide (Y2o3) Prepared Via Ultrasonic Technique For Solid Oxide Fuel Cell (Sofc) Application.**

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**Abstract**― Solid oxide fuel cells (SOFC) are the current research having several potential to obtain high efficiency, high energy–density power generation which operated at relatively higher temperature. Yttrium oxide (Y2O3) contributions at high temperature are accelerating to the development oxide layer of FeCr alloy. The aim of this research is to investigate the microstructure of Fe/Cr added with Y2O3 acting as a reactive element. The purpose is to improve macrostructure of Fe/Cr powders which can be applied at steel industry. In this study the mixing process of Fe/Cr and Y2O3 powder was conducted via ultrasonic treatment at a frequency of 22 kHz, and at two different holding time of 2.5 h and 3.5 h. The particle size of chromium (Cr) can be reduced by ultrasonic treatment at from 60µm to 30µm through threshing the cluster of Cr particle. It shows that the ultrasonic vibration effectively removes oxides and other contaminates on a surface coating. Therefore, homogeneity of the parent material, segregation, and uniform distribution of second phase were increased..

**Keywords:** *Solid oxide fuel cells; Iron Chromium; ultrasonic treatment*

**Microstructure and Magnetic Properties of Barium Hexaferrite Produced by Sol Gel**

**Auto combustion For Radar Absorber Material (RAM) Application**

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**Abstract**― Barium hexaferrite (BaFe12O19) with hexagonal structure had been known as the high performance magnetic for Radar Absorber Material (RAM). Barium hexaferrite (BaM) was synthesized by sol gel auto combustion to get a homogeneous nanoparticle of BaM. It was obtained from solution mixture between barium nitrate and ferri nitrate nonahidrat with precipitation of ion barium (Ba2 +) and ferri (Fe3 +) by solution of sodium hydroxide. Samples were prepared with mol ratio of Fe / Ba 11, added ammoniac in order to get pH varies in 7.5;

9, and 11. Combustion process is induced by adding citric acid. The stirring time were performed in 1, 2, and 3 hours, respectively. The effect of pH, stirring time, microstructure, phase, and magnetic properties were

investigated using X-ray diffraction (XRD), Scanning Electron Microscope (SEM) and a vibrating sample magnetometer (VSM). The results showed that the highest coercivity was 0.6 Tesla and the smallest crystal size

414.409 nm was obtained for pH 7.5 and stirring time in 2 hours. Moreover, the largest magnetic saturation 55.54 emu/g was reached for pH 7.5 with stirring time within 1 hour.

**Keywords:** *barium hexaferrite; sol gel; pH*

**The Effect of Dioctyl Phthalate Plasticizer on Thermal Properties of Polylactic**

**Acid/Empty Fruit Bunch Composite**

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**Abstract**― Usages of biodegradable polymers such as polylactic acid (PLA) are currently emerging as a substitute for conventional plastics due to environmental regulations. This naturally derived polymer however possesses some obvious limitation such as limited temperature stability which leads to poor thermal resistance. Plasticizer is added to lower the glass transition temperature,T\_g to contribute significant increase on ductility and softness to PLA to broaden its applications. In this research, PLA is blended with treated empty fruit bunches (EFB) fibres as the filler. However, the biocomposite formed is rigid and brittle. Therefore, varying amounts of Dioctyl Phthalate (DOP) plasticizers are added to improve the biocomposite thermal stability. The thermal properties of biocomposite was investigated using differential scanning calorimeter (DSC) and thermogravimetric analysis (TGA). The DSC thermogram, shows that DOP effectively decrease the T\_g up to 15% with addition of 20% DOP into the biocomposite. DOP diffuses in the molecular chain and aids in increasing the PLA/EFB biocomposite chain mobility and prevents crystallization of the chains. The degradation temperature obtained from TGA shows enhancement on the leftover residue corresponding with the amount of DOP added to the PLA/EFB biocomposite.

**Keywords:** *Poly-lactic acid; Empty Fruit Bunches; Dioctyl Phthalate; Thermal Properties*

**The Influence of Carboxy Methyl Cellulose (CMC) and Solution pH on Carbon Fiber**

**Dispersion in White Cement Matrix**

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**Abstract**― Dispersion of carbon fiber in cement matrix is one of main challenges for fabricating carbon fiber reinforced cement based materials. In this study, the dispersion of carbon fiber was improved by pre-dispersion of carbon fiber in basic aqueous solution using different concentrations of CMC. The relationships of CMC concentration and pH solution toward carbon fiber dispersion in aqueous solution was evaluated by UV–vis spectroscopy. In order to understand how carbon fiber is dispersed in cement matrix, morphology and resistivity of fiber carbon reinforced composite was examined. Experimental results show that aqueous solution of CMC is effective to disperse carbon fiber. In addition, dispersion of carbon fiber increases with increasing of pH of CMC solution.

**Keywords:** *carbon fiber reinforced cement composite; cementitious material; carbon fiber dispersion;*

*carboxymethyl cellulose*

**Effects of Heat Treatment and Titanium Nitride (TiN) Coating Deposited by**

**Sputtering PVD Technique on Duylos 2510 Tool Steel Substrate**

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**Abstract**― The objective of this research is to characterize the effects of TiN coating and heat treatment such as quenching, tempering on mechanical and physical properties of duylos 2510 steel. These mechanical properties include wear rate, hardness, impact toughness, whereas physical properties are microstructures. Duylos 2510 steel is a cold work tool steel and has chemical composition (wt %) of 1C; 0,6 Cr; 0,1 V; 1 Mn; 0,25 Si and 0,6 W. TiN coating has been deposited on substrates by sputtering technique of PVD (Physical Vapor Deposition) at temperatures of 100, 150, 200 and 250 oC with sputtering time of 45 minutes. Quenching processes have been conducted on uncoated substrates (specimens without TiN coating) by heating the specimens at austenite temperature of 800 oC with the soaking time of 30 minutes and then these specimens were cooled rapidly in oil medium. Tempering processes were done at temperatures of 100, 200, 300, 400, 500 dan 600 oC with holding time of 2 hours. And then the quenching and tempering specimens were coated by TiN at sputtering time of 45 minutes and sputtering temperature of 200 oC. The mechanical and physical properties have been characterized by wear test, Vickers micro hardness test, Charpy impact test, and metallography test. This research was performed at room temperature and the major parameters of this research were tempering and sputtering temperatures.

The results show that tempering temperature variations give significant modification of mechanical properties. In general, the Vickers micro-hardness decreases if tempering temperatures of the specimen increase. The highest Vickers micro-hardness of TiN coatings is 290 HV0,01 for the specimen having sputtering temperature of 200 oC.

Wear rate and impact energy increase if tempering temperatures increase. The results also show that the Vickers micro-hardness of coated specimens is higher than the micro Vickers hardness of non-coated specimens.

**Keywords:** *TiN coating; quenching; tempering hardness; wear*

**Numerical simulation of the influence of the inlet design in a MOCVD reactor**

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**Abstract**―Controlling the thickness and uniformity of the epitaxial layer during MOCVD growth is very important for ensuring the quality of Gallium Nitride light-emitting diodes. One important factor leading to non- uniform deposition is the appearance of a vortex in the reactor caused by the thermal buoyancy and inertial forces. Three-dimensional numerical simulations based on the finite-element method are carried out to study the influence of a subsidiary inlet ring jet on the appearance of this vortex. Results show that the strength of the vortex can be reduced with a higher flow rate through subsidiary ring jet. The ability to prevent the precursor toward the chamber wall by the flow motion induced by the subsidiary ring jet can be enhanced by increasing the flow rate or wall temperature of the chamber. Pollution from the precursor can be prevented by utilization of the proper flow rate through subsidiary ring jet and wall temperature of the chamber

**Keywords:** *3D FEM simulation; inlet design; Gallium-Nitride; MOCVD*

**Effect of Heat Treatment on Microstructure Homogeneity of Zn-3Mg Alloy**

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**Abstract**― The Zn based alloy has a high potential to be the next generation of biodegradable implant material. Development of this biomaterial involves casting process which often associated with various defects. In this study, Zn-3Mg alloy was prepared using conventional casting method and followed by homogenization treatment (370oC for 10hr) with the aim to improve the microstructure uniformity. Microscopic images show that as-cast Zn-3Mg alloy consists of segregated Zn-rich structure of star-like dendritic shape and eutectic mixture of Mg2Zn11 phase. It is observed that after the heat treatment process thissegregation has been dispersed well and results in a more uniform microstructure of Zn-3Mg alloy with low fraction of casting defects.

**Keywords:** *Zinc alloy; biomaterials; heat treatment; dendritic; homogeneity*

**Experimental Study of Impact on Carbon-Fiber-Epoxy Composite Wing Leading**

**Edge Structure**

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**Abstract**― This paper works on the curvature composite structure for wing leading edge application using fabric carbon/epoxy material subjected to impact loading. At first stage, rigid spherical projectile and elliptical panel with were used. The impact testing has been carried out by varying the radius of curvature, the thickness of the panel and different stacking sequence. The experimental results show the trend of specific energy absorption capability of structure in function of the radius, thickness of panel and carbon fiber directions.

**Keywords:** *composite; wing leading edge; impact loading; energy absorption*

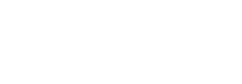
**Repair Development of Silencing Skin Exhaust Cone**

Nanang Yulian, Winda Afrilia Rachmadani, Arif Sugianto, H.C. Kis Agustin, Muhamad Yunus

**Abstract**― Repair development has been performed on the cracked of silencing skin of exhaust cone. Repair technics are performed using GTAW welding process with two methods, namely the addition of solid shaped doubler and perforated doubler. Based on Structural Repair Manual, silencing skin of exhaust cone made from Inconel 625. To support this repair technic and accordance with the qualification standards for fusion welding according to AWS B2.1 and D17.1, laboratory practices must be performed including specimen preparation and visual inspection, non-destructive testing, shear and principal tensile testing, hardness testing, joint geometry measurement, metallography observation, performance qualification statement, and safety assessment. The results of experimentation and testing this repair development of silencing skin of exhaust cone are expected to issue a repair scheme as well as to choose the proper doubler method based on qualifying results.

**Keyword:** *Exhaust cone, silencing skin, GTAW Process*

**The Assessment of Material Characteristic using Vibration Signal Analysis during**

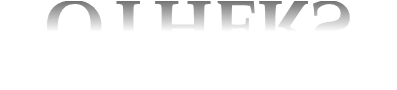


**Drilling Process**

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**Abstract**― The purpose of this paper is to assess the material characteristic by using vibration signal analysis during drilling process. Generally, material with high mechanical properties exhibits low damping capacity and vice versa. The main objective of this paper is to develop a relationship between the signal parameters and the strengths of materials. Aluminium alloy 1100, stainless steel 304, and mild steel were selected as the specimens to be drilled using CNC machine. The vibration signal was captured using a transducer and recorded using a DAQ system. The signal parameters such as maximum amplitude, vibration energy, and the RMS value were extracted using MATLAB software. From the results obtained, the graphs of signal parameters versus strength of each specimen are plotted to show their relationship. It was found that the signal parameters increased exponentially as the strengths of materials increased. Besides that, the vibration signal of the specimens are analysed and compared based on their mechanical characteristics.

**Keywords:** *material characteristic; vibration; maximum amplitude; vibration energy; RMS*



**OTHERS**

**Design Cost and Scaling Model of Superconducting Wind Turbine Generator for**

**Electricity Generation**

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**Abstract**― This paper reports on the design cost and scaling model of a small scale superconducting wind turbine generator, where the levelized cost of energy (COE) was calculated. The proposed design of the wind turbine is based on the vertical axis wind turbine (VAWT) type that drives the superconducting generator. VAWT is chosen due to its ability to operate under low wind speed. Wind turbine using superconducting generator is proposed since it is able to enhance magnetic flux within the stator of the generator and consequently improved the performance of the generator. Once the design has been accomplished, all the cost of parts and components must be accounted and contributes to the overall cost of generating electrical energy from the superconducting wind turbine generator. The cost elements include the initial capital cost (ICC), balance of station (BOS), operation and maintenance (O&M), levelized replacement cost (LRC) and annual energy production (AEP). The calculated levelized COE shows that the cost of generating electricity using superconducting wind turbine generator is lower than generating electricity from conventional sources.

**Keywords:** *Superconductor; Superconducting wind turbine generator; Wind energy*

**Wind speed, wind flow and a case study of mounted-wind turbine in a tall building for power generation**

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**Abstract**― Mounted wind turbine on the top of tall building may provide high wind power in regions of high wind speed and low turbulence. This study investigated the power of the wind increases with the cube of the wind speed and wind flow characteristics. The objective of this study is to evaluate the performance of wind speed and wind flow in the roof top models of the tall building to optimize the wind turbine for power generation. Comparative analyses from three different roof top models were conducted. Computational Fluid Dynamics (CFD) simulation and wind tunnel testing was performed to evaluate the performance of wind turbine on the rooftop of tall building. Wind speed on the building model with a geometric scale of 1:150 was measured in CFD simulation then validate in wind tunnel test. Results presented in this paper suggest that an increase the wind speed could be achieved with ¼ circular shapes around the rooftop which can reach 55.24% more than wind speed approach.

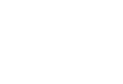
**Keywords:** *Wind speed; Wind flow; Roof shape; CFD; Wind tunnel; Tall building*

**High-Efficiency Shrouded Micro Wind Turbine for Urban-Built Environment**

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**Abstract**― Shrouding (diffuser augmented) horizontal axis micro-wind turbine has been shown to be an effective ways to potentially increase the power output of micro wind turbine for applications in built environments. It is well understood that the degree of the performance enhancement depends on several factors including the diffuser shape and geometries, blade airfoils, and the wind condition at the turbine site. The effect of diffuser shape and geometries is reported in this paper. Computational fluid dynamic (CFD) simulations of a small wind turbine with a simple frustum diffuser shrouding have been carried out. The diffuser has been modeled with different shapes with the aim to understand the effect of length and area ratio on power augmentation phenomenon. The simulations provide some parameterized figures which present method to determine the beneficial range of frustum diffuser geometries for diffuser shrouded horizontal axis wind turbines

**Keywords:** *computational fluid dynamic; coefficient of performance; diffuser; micro wind turbine; shroud*



**Development of Superconducting Wind Turbine Generator Prototype for Electricity**

**Generation**

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**Abstract**― High energy demand and issue of carbon emission from fossil fuel have increased the interest of using wind turbines for electricity generation. Nevertheless in the case of Malaysia, one of the factors that deter the generation of energy from wind is the low volume of wind. Normally, a consistent measurement about 5.00 to 10.0 m/s of wind speed is needed to be able to generate sufficient source of energy from wind turbines. In contrast the average wind speed in Malaysia is about 3.50 to 4.00 m/s. To compensate the low wind volume, one of the possibilities is by using superconducting generator for the wind turbine. Simplification of the mechanical design where the turbine blades can be connected directly to the generator without a gearbox will provide an efficient and compact sized wind turbine. Furthermore, superconducting coils in the generator are able to enhance the current density that produces high magnetic fields and the same time reduces mass and size of the superconducting machines. This paper describes the design study of small size superconducting generator where the drive train comprises of the turbine blades are connected directly to the generator. Direct current synchronous single-phase series generator has been chosen as the base for development of the superconducting generator. The design is specifically targeted a low-speed wind environment but has the ability to produce high-torque direct- drive.

**Keywords:** *superconducting generator; wind turbine generator prototype; wind turbine*

**Energy Conversion in Compliance of Energy Self-Sufficient Village Program. Case study: Jarak Village**

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**Abstract**― The Energy Self-Sufficient Village (ESSV) is one of the main programs from Goverment of Indonesia (GoI) initiated in 2007 and addressed to improve the capability of rural areas to meet the local energy demand from renewable energy. The fulfillment of 60% energy demand is required in ESSV and the source of the energy must be renewable energy. Jarak Village has potentialas to be developed as an ESSV since it has 237 cattles generated manure waste can be converted into biogas. However, the actual conditions showed that the utilization of manure waste as source of biogas is only 14% or about 124,2 kWh covering the energy demand from 40 households. The estimation of the total cattle available in the village can actually covers up to 62% energy demand. The existing numbers of cows generate 82.8 m3 biogas equivalents to 124,2 kWh. Nevertheless, only

124,2 kWh 14% has been consumed by 40 households. It indicates that the consumption of biogas is not optimal. Therefore, the study purposes to evaluate and to estimate the capability of the village to meet the criteria of ESV.

With the assumption that there is population growth 0.01%, the criteria of ESV can be fulfilled in 2014. The

energy supply of ESV in 2014 is 62%. It indicates that the Jarak Village can actually meet the criteria of ESV in

2014.

**Keywords:** *The Energy-Self Sufficient Village; manure waste; biogas*

**Development and evaluation of Nano Electret Filters for Household Water Treatment**

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**Abstract**― Korea is expected to one of countries with water shortages, and thus must secure high-quality water resources and strictly maintain them. However, water is frequently polluted and there is still a lack of water treatment technologies and facilities to provide safe water. To remove pollutants, membrane-based methods are being widely used for water treatment. It needs high pressure and energy to capture the pollutants by pore size. In this study, electrostatic force is used to increase the efficiency of filtration and decrease pressure loss. By electro spinning, nano electret filter is made with 100 nm in diameter and positive charge potential. Surface potential is measured by electrostatic voltmeter system with nano electret filter by three conditions of applied voltage. For the filtration performance, filtration efficiency is measured by filter test system with 0.5 and 1.0 PSL. Also pressure loss of nano electret filter is measured by comparing PC membrane.

**Keywords:** *Nano electret filter; Electrospinning; Pressure loss; Surface potential; Water treatment*

**Decontamination and Treatment Process for Efficiency of HVAC Building**

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**Abstract**― Concern has arisen on the build up of microorganisms that colonise heating, ventilation and air conditioning (HVAC) systems. Two products were developed to address this problem; a multi-enzyme based product that cleans and eliminates biofilm containing dirt and microorganisms on the HVAC components, and a bioactive treatment coating that prevents regrowth and proliferation of bacteria and fungi. In this paper, assessments were made on microorganisms captured from biofilms occurring in “nature” rather than using standard laboratory organisms. Using the proposed treatment, coated film retains their anti-microbial activities for up to 365 days and the air velocity to the air conditioning unit increased between 8% to 14% with power reduction of 16%.

**Keywords:** *decontamination; HVAC; treatment; efficiency*

**The Emergy Value Assessment of Municipal Waste Management in Yogyakarta, Indonesia**

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**Abstract**― The emergy values of three different scenarios for the new landfill in Yogyakarta City were calculated to evaluate the sustainability and efficiency. The assessment included the environmental parameters which are Environmental Yield Ratio (EYR), Net Emergy, Environmental Loading ratio (ELR) and Emergy Sustainability Index (ESI).

The calculation of emergy indices showed that treatment in landfill requires the largest emergy input for all scenarios with the percentage between 92% and 97%. Scenario 0 contains the lowest total solar emergy implying

that it requires lower emergy input compared to other scenarios. Scenario 1 needs the lowest emergy investment. Meanwhile, Scenario 2 offers the highest emergy recovery contributed mainly by the output from higher scavenging rate. Scenario 2 is the best option for the municipal waste management in Yogyakarta since it meets

more criteria for sustainability and efficiency. Introduction

**Keywords:** *municipal waste management; environmental parameter; emergy value; Yogyakarta; Indonesia*

**Validation of AWTSim as Aerodynamic Analysis for Design Wind Turbine Blade**

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**Abstract**― This paper presents about validation of AWTSim code is used to analysis aerodynamic performance in the optimization design blade wind turbine. Validation was perform in this study to know the accuracy of code compared to WT\_Pert by using the test wind turbine AWT-27. AWT-27 is taken as the case for study all through this project and the design pitch angle for AWT-27 is 1.2° to stall (-1.2). However, in order to compare the results with available results, pitch angles 0, 1 and 2 degrees to stall are considered for simulation. The result of validation show that the predicted power curve, power coefficient and thrust by two code is almost similar.

**Keywords:** *Validation; aerodynamic; performance design blade; blade element momentum theory*

**Computational Fluid Dynamic using Parallel Loop of Multi-Cores Processor**

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**Abstract**― Computational Fluid Dynamics (CFD) software is frequently used to analyze fluid flow and structures motion in fluids. The CFD normally requires large size of arrays and computer memory and then caused long execution time. However, Innovation of computer hardware such as multi-cores processor provides an alternative solution to improve this programming performance. This paper discusses loop parallelize multi-cores processor for optimization of sequential looping CFD code. The loop parallelize CFD can be achieved by applying multi- tasking or multi-threading code into the original CFD code which was developed by one of the authors. The CFD code was developed based on Reynolds Average Navier-Stokes (RANs) method. The new CFD code program is developed using Microsoft Visual Basic (VB) programming language. In the early stage, the whole CFD code was constructed in a sequential flow before it is modified to parallel flow by using VB’s multi-threading library. In the comparison, fluid flow around the hull of round-shaped FPSO was selected to compare the performance of both the programming codes. Besides, executed results of this self-developed code such as pressure distribution around the hull are also presented in this paper.

**Keywords:** *Parallel Computing Reynolds Average Navier-Stokes; Computational Fluid Dynamics; Round-shaped*

*FPSO*

**Parallel Speed-up of Preconditioned Fractional Step Navier-Stokes Solvers**

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**Abstract**― Parallel performance of the fractional step Navier-Stokes solver is investigated. Parallelisation is performed using Message Passing Interface, with domain partitioning. Block preconditioning is applied to the solution of the pressure Poisson equation, which is often the bottleneck in the computation of the fractional step method. Preconditioners tested are classes of incomplete matrix decompositions and sparse approximate inverses. The computational domain is decomposed into eight parts of about equal sizes in terms of the number of cells, and solved in eight parallel processes. Several aspects in parallelisation, such as domain splitting directions, speed- up and scalability of the preconditioners, are discussed.

**Keywords:** *parallel; preconditioning; sparse approximate inverse; fractional step*

**Meshfree Method To Predict The Effect of Corrugated Bed on Hydraulic Jump**

**Characterictic Especially Energy Dissipation**

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**Abstract**― A hydraulic jump is a common phenomenon which can be observed in open channels flow such as rivers and spillways. It can cause damage of the downstream bed and bank of the channel due to the process of continuous erosion and degradation. In order to reduce the hydraulic jump destruction, the energy in the hydraulic jump must be dissipated as much as possible. One method to increase dissipation of energy is using a corrugated bed. In order to know the effect of a corrugated bed on the hydraulic jump, a smoothed particle hydrodynamics (SPH) model is applied to investigate the characteristics of hydraulic jumps in various corrugated beds. A variety of corrugated beds which are smooth, triangular, trapezoidal, and sinusoidal are considered. The opening of a gate is changed to adjust the hydraulic jump. The energy dissipation are reported. The results of the present study are in a good agreement with previous studies. Energy dissipation is compared among corrugated beds and a smooth bed. It is found that the sinusoidal bed can dissipate more energy than other beds. As a result, corrugated beds can be used to enhance energy dissipation of hydraulic jump in the open channel. In general, the proposed SPH model is capable of simulating the effect of corrugated beds on hydraulic jump characteristics.

**Keywords:** *Corrugated bed; Free surface flow; Hydraulic jump; Smoothed particle hydrodynamics*

**Neural Network-Based Engine Propeller Matching (Nn-Epm) For Trimaran Patrol**

**Ship**

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**Abstract**― In recent years efforts on reducing fuel consumption has become the greatest issue related to energy crisis and global warming. The reduction of fuel consumption can be obtained, if the ship propulsion could be operated in its best performance level. Generally this is done by an appropriate analysis of engine propeller matching (EPM). In this study an EPM based on neural-network method, or NN-EPM, is established to predict the best performance of main engines, leading at minimum fuel oil consumption. A trimaran patrol ship is selected as a case study. This patrol ship is equipped with two 2720 kW main engines each connected to a controllable pitch propeller (CPP) through a reduction gear. The input parameters are ship speed V and service margin SM, with the corresponding output parameters comprise of engine speed nE, engine break horse power PB, propeller pitch P/D, and the fuel consumption FC. An NN-EPM 2-20-15-4 configuration has been constructed out of 100 training data and then validated by 30 testing data. The maximum relative error between results from NN-EPM and EPM analysis is 2.1%, that is in term of the fuel consumption. For other parameters the errors are well below

1.0%. These facts indicate that the use of NN-EPM to predict the main engines's performance for trimaran patrol ship is satisfactory.

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**Keywords:** *Engine propeller matching; Service margin; Backpropagation Neural Network; Sequential turbocharger*

**Pipeline Leak Detection in Two Phase Flow Based on Fluctuation Pressure**

**Difference and Artificial Neural Network (ANN)**

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**Abstract**― Pipe network was an important part of the fluid transport infrastructure. On the other hand, the pipeline leak detection in two-phase flow using the flow and pressure parameters is very rarely studied. A system on the basis of the Artificial Neural Network (ANN) was proposed for detecting the pipeline leak for the two-phase plug flow by using the pressure difference measurement. In the present research, water-air mixture flows in pipe horizontal of 24 mm inner diameter. Artificial pipeline leak was modeled with the leak of solenoid valve on the bottom and top of pipe. Differential Pressure Transducer (DPT) was placed after the leak position and connected by the high-speed data acquisition. The fluctuations of the pressure difference signals were recorded as a time series of random data. The data of the combinations of the input flow rate, the pressure difference can be used to identify the pipeline leak in two-phase flow plug by using ANN. The results demonstrated a very good ability to the pipeline leak on two-phase flow.

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**Keywords:** *pipeline leak; two-phase flow; fluctuations pressure difference; artificial neural networks*

**Optimization Of Maximum Lift To Drag Ratio On Airfoil Design Based On Artificial**

**Neural Network Utilizing Genetic Algorithm**

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**Abstract**― Utilization of wind energy as an alternative energy resource in Indonesia is technically still having some problems mainly due to relatively low average wind speed, ranging from 2.5 to 6 m/s. Meanwhile, wind turbines which are commercially available were so far adapted to the conditions of the manufacturer country, where the average wind speed is high enough (above 8 m/s). For these reasons, it is necessary to develop wind turbines which are suitable to the wind characteristics in Indonesia. On the other hand, the most important aspect of wind turbine blade design is determination of airfoil geometry which is expected have a maximum value of lift to drag ratio (CL/CD). For this purpose, an alternative airfoil design method based on combination of smart computing and optimization method has been developed. At this method, a simulation of Artificial Neural Network (ANN) for determining the relation between airfoil geometry and its aerodynamic characteristics was conducted. First, several airfoil geometry are generated through transformation of complex variables (Joukowski transformation), and then lift and drag coefficients were determined using CFD (Computational Fluid Dynamics). The ANN then was trained using these obtained data (airfoil geometries and its aerodynamic characteristics), so lift and drag coefficients can be directly determined if the airfoil geometry is given without having to perform wind tunnel experiments or numerical computation. Moreover, the optimization is conducted to get an airfoil geometry which gives maximum CL/CD for specific Reynolds number. In this work, Genetic Algorithm was applied as optimizer. The results were validated using commercial CFD and it can be shown that the result are satisfactory with error approximately of 6%.

.

**Keywords:** *Aerodynamics; airfoil; Artificial Neural Network; CFD; Joukowski Transformation; Genetic*

*Algorithm*

**Quad-rotor CFD Simulation and Analysis with Artificial Neural Networks error compensation**

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**Abstract**― Miniature helicopters are a popular device used in the research of unmanned aerial vehicles (UAVs) due to their simple yet unique design. Regardless of their simplicity in the hardware design, the vehicles remain intrinsically unstable. The effect of a disturbance, such as wind on the control of a small vehicle of this nature can be quite significant and pose a danger in outdoor flight when obstacles or other vehicles are in sight. This work aims to improve quad-rotor control performance by modelling the helicopter and analysing effects of wind on the vehicle dynamics, paving way for the development of a novel robust controller in the near future. In this paper, CFD (Computational Fluid Dynamics) simulation results of a 3-D Solidworks model of the quad-rotor helicopter are compared with results from real flight experiments. Though a general agreement between the numerical and experimental results was found, the need for greater precision led to the development of a neural network model to compensate for the errors of the CFD simulations. It was found that the error was reduced by about 15%.

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**Keywords:** *Quad-rotor; CFD; Neural Networks; UAV; Aerodynamics*

**Organizational Culture in Manufacturing Company: Study Case of Small and**

**Medium Sized Enterprises in Central Java, Indonesia**

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**Abstract**― This paper discuss the organizational culture in metal manufacturing company which is classified as small and medium sized enterprises (SME) located in Central Java Province, Indonesia. This study is conducted to observe the action of the SME, especially for metal manufacturing company to face the regional free trade agreement in South-East Asia as a consequence of global market. The organizational culture is classified based on the internal factor, external factor, stability and control and flexibility and discretion. Four companies are involved in this study, where Company A, B and C are classified as small enterprises and Company D is classified as medium enterprise. The results described that the organizational culture is “adhocracy” for Company A, “market” for Company B and Company D and “hierarchy” for Company C. The “adhocracy” cultured company is predicted to be survived in ACFTA due to their innovative, customized and unique metal product and also specific customer. The medium enterprises is predicted to survive in ACFTA era due to their strong organizational structure, focused future plan, product diversification and measured product quality and standardization. The organizational culture for SMEs which is predicted to be suitable in winning ACFTA competition is “adhocracy” and “market” and supported by the product innovation, diversification and quality control. Mechanical and industrial engineers from university should takes place in assisting and supporting SMEs to win the competition in ACFTA era

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**Keywords:** *Manufacturing Company; Metal Product; Organizational Culture; SME; Indonesia*

**Modeling the Effect of Compression Ratio on Rotors of Wankel Engine under**

**Isothermal Conditions**

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**Abstract**―In engine design one of the key parameter is compression ratio which describes its sustainability of design under given conditions. The effects of compression ratio on engine help in stress analysis of different parts of engine. In this paper stress analysis are performed on the two rotors of Wankel engine utilizing the commercial code of solidworks under isothermal conditions. The selected rotors are different in shape and geometry. These rotors are compared on the basis of compression ratio. The results show Von Mises stress analysis for both rotors of different shape and geometry.

**Keywords:** *Wankel engine; Rotor; Housing; Compression ratio; Stress analysis*

**Failure Analysis of the Gear Boxes used in Waste Water Pumping Stations; Case**

**Study**

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**Abstract**― The analytical and experimental analysis of this paper give the results of an investigation of a premature failure of the gears of the reducer gearboxes used in waste water lifting stations located at Al-Khossous and Kalag at Cairo, Egypt. Standard investigative procedures are employed in this analysis. It was found that the gear teeth failed has been caused by a surface fatigue fracture. Detailed examination of the surface of the gear teeth revealed that extensive surface damage has been occurred in the form of spalling accompanied with sub- surface cracks and damages. Such observations indicated that the gear teeth were under excessive contact stresses during operation. These surface and sub-surface damages lead to fatigue crack initiation followed by crack growth and eventual fracture. It is concluded that the fatigue fracture of the helical gears have been initiated by an excessive contact stress arised on the surfaces of the gear teeth due to the lack or inefficient gear lubrication.

**Keywords:** *Gear boxes; Failure analysis; Surface fatigue; Contact stresses; Case hardening*

**Evaluation of Garden Tools Set and Its Performance Characteristics**

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**Abstract**― A laboratory and field trial program were undertaken by Automotive Development Centre to determine the performance of a garden tools set consisting of an engine, pruner, trimmer, blower and auxiliaries. The garden tools set was produced to apply three types of tools (pruner, trimmer and blower) operated using one source of prime mover. The tools will be connected to the engine by a “plug and play” quick coupling. The tools are powered by two stroke engine of 27cc capacity. The scopes of this experimental work are to measure the pruner cutting rate, trimmer cutting rate, blower thrust force and garden tools noise test. All tests are done at variable speed of engine. The measured parameter for the pruner cutting rate is the area of branch (mm2) per cutting time (second) with difference thickness and for the trimmer cutting rate, the parameter is the area of grass space (mm2) per cutting time (minute) with difference length. Whilst for the blower thrust test, the blower force is measured by the weight machine with the difference distance. The noise test was performed to the garden tools at difference speeds and locations. From this work, the result for each tool is determined. The cutting rate of the trimmer is at the range of 3.22 to 4.55 mm2/min, whereas for the pruner is from 500 to 1210 mm2/sec. The thrust measured for the blower is between 30 to 105 kg/ms2. The noise level generated by the garden tools is at the range of 61 to 94 dB when operating from 1000 to 7000 rpm.

**Keywords:** *Garden Tool Sets Performance; Cutting Rate; Noise level*

**New Polyhedral Elements Based on Virtual Node Method for Solid Mechanics and**

**Heat Transfer Applications**

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**Abstract**― Finite element method (FEM) is a well-established method and commonly utilized to solve complex engineering problems which cannot be solved analytically. Various element types have been formulated over the years to facilitate engineering analyses using FEM. In this paper, new polyhedral elements are developed by utilizing virtual node method. This paper covers the formulation of shape functions and integration schemes for the new polyhedral elements. These new polyhedral elements have advantages due to the nature of their shape functions which consist of monomials uavbwc. Integration of functions within the element can be accomplished by utilizing an exact integration technique. These polyhedral elements can be utilized to solve real 3 dimensional problems which arise in solid mechanics and heat transfer phenomena.

**Keywords:** *Finite element method; polyhedron tetrahedron; 3 dimensional virtual node method; exact integration*

**Slump Flow Modelling of Self-Compacting Conrete using Smooth Support Vector**

**Regression (SSVR)**

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**Abstract**― A new method of prediction based on smooth support vector regression (SSVR) is introduced to resolve the slump flow modeling of self-compacting concrete (SCC). The slump flow is a function of the content of all concrete ingredients, including cement, silica fume, water, superplasticizer, coarse and fine aggregate. In this paper, the basic ideas underlying SSVR are reviewed, and the potential of the SSVR for multiple regression (modeling) problems is demonstrated by applying the method to model of slump flow from experimental data. The results of experimentation indicate that SSVR has excellent performance on slump flow prediction. Compared with traditional prediction method such as second order regression, SSVR has much more accurate and effective to prediction of slump flow and it is very promising result.

**Keywords:** *self-compacting concrete; slump flow modeling; smooth support vector regression*

**Image Processing Implementation in Measurement of Cross-Flow Water Turbine**

**Geometry**

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**Abstract**― Recently, many studies have been done to look for renewable energy sources such as kinetic energy from marine or fluvial currents. In its utilization, water turbine plays an important role for taking energy from water current. One of the water turbine types is Cross Flow Water Turbine (CFWT). The performance of the CFWT depends on its geometry. Unfortunately, its geometry is very difficult to be measured using conventional measurement because it has complex geometry. Hence, a non-conventional measurement system based on image processing is proposed in this study to deal with the measurement difficulty of the CFWT geometry.

**Keywords:** *cross-flow water turbine; non-conventional; measurement; image processing*

**Computer Assisted Fracture Reduction and Fixation Simulation for Pelvic Fractures**

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**Abstract**― The objective of this study is to present an integrated surgical simulation program on a personal computer for the preoperative planning of pelvic fractures. It first provides a visualization module to display 2D images and 3D model simultaneously. A semi-automatic bone segmentation module is then provided to separate the bony structures, enabling the manipulation of individual fractured bone and bone fragment. A bone reduction module is provided for the localization of the fractured bones. The simulation of plate and screw fixation is also presented, which provides useful information for determining the shape and size of the implants. Also, an example with real CT images are presented to demonstrate the feasibility of the proposed method

**Keywords:** *Pelvic preoperative planning; Bone reduction; Bone Segmentation; Pelvis surgery*

**Design online Artificial Gain Updating Sliding Mode Algorithm: Applied to Internal**

**Combustion Engine**

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**Abstract**― This paper presents an online Artificial Fuzzy sliding Gain Scheduling Sliding Mode Control (AFSGSMC) design and its application to internal combustion (IC) engine high performance nonlinear controller in the presence of uncertainties and external disturbance. The fuzzy online tune sliding function in fuzzy sliding mode controller is based on Mamdani’s fuzzy inference system (FIS) and it has multi input and multi output. The input represents the function between sliding function, error and the rate of error. The output represents the dynamic estimator to estimate the nonlinear dynamic equivalent in supervisory fuzzy sliding mode algorithm. The performance of the AFSGSMC was compared with the IC engine controller based on sliding mode control theory (SMC). Simulation results signify good performance of fuel ratio in presence of uncertainty and external disturbance.

**Keywords*:*** *internal combustion engine; sliding mode controller; fuzzy controller; on-line sliding fuzzy gain*

**System Architecture and FPGA Embedding of Compact Fuzzy Logic Controller for**

**Arm Robot Joints**

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**Abstract**― This research is about the system architecture for embedding of the Compact Fuzzy Logic Controller (Compact-FLC) into the FPGA with a minimal need in device resource. This exciting research is to minimize the FPGA resources needed to build Compact-FLC based on FPGA for controlling each joint of arm robot’s manipulator. Compact-FLC results of this research have been used in the XILINX Spartan 3 XC3S1000 FPGA. The Compact-FLC has been applied with satisfactory results as Servo Controller for one joint of arm robot manipulator which the results showed that the controller achieved a process speed of 65,4uS, which is equivalent to a maximum sampling frequency of 15.290 KHz. Output membership function in this Compact-FLC used singleton membership function with Center Of Area algorithm. Two input membership functions, i.e E (Error) and CE (Change Error) have been used, both formed from several combination of triangular membership functions. The maximum number of fuzzysets that can be processed is sixteen. The overlapping function is not limited because there have been 256 if-then rule available as look up table in FPGA's ROM. The device utilization summary from ISE of XILINX development software gave the following data: Slice FlipFlops needed are 3869 or 25% of 15360 availability, 4 input LUT needed are 2319 or 15% of 15360 availability, Blocks of RAM needed are 4 or 16% of 24 availability, MULT18x18s needed are 2 or 8% of 24 availability, GCLKs needed are 2 or 25% of 8 availability, Bonded IOBs needed are 32 or 18% of 173 availability.

**Keywords*:*** *Robotic; Arm Robotic; FPGA; Fuzzy Logic Controller; FLC; Embedding; Digital Control*

**Experimental-based TGPID Motion Control for 2D CNC Machine**

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**Abstract**―2D (two-dimensional) motion is the basic motion for computer numerical controlled (CNC) machine in all industrial applications. In this paper, it is aimed to optimize the multi-performance characteristics, namely roundness error determined by best-fit-circle (REB), actual radius (R\_act) and position time (Tt) that is the time needed for making a circular motion. By applying a Taguchi – Grey – Proportional Integral Derivative (TGPID) control method, the performance of this 2D multi linear motion is improved. The roundness error is closed to zero as time went to infinity which means the actual radius is closed to the reference radius. The position time differences (dTt) of X and Y axis for circling is also zero. This indicated the TGPID approach is robust.

**Keywords*:*** *Taguchi; Grey; PID; motion control; optimization; CNC*

**Preliminary Study on Magnetic Levitation Modeling Using PID Control**

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**Abstract**― This paper proposes to understand about basic magnetic levitation model. Magnetic Levitation is repulsive or attractive force resulting gap from magnetic field. Characteristic of the magnetic levitation model is used permanent magnet and electromagnet with PID control to maintain wide gap between levitator and object levitation. Mass addition is used to analysis the model of the Maglev with PID control to maintain wide gap. Calculation result show that the maglev with PID control has sufficient levitation force in the maintain wide gap. Comparison between calculated and measured values can be done to build a another complex model magnetic levitation.

**Keywords*:*** *modeling magnetic levitation; PID control; gap; electromagnet*

**Actuator Power Consumption of Active Suspension System with Override Control**

**Strategy**

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**Abstract**― The main function of the vehicle suspension is to improve ride and handling performance. In vehicle active suspension, better ride comfort is usually required larger control input and larger suspension deflection. However, the actuator that deliver the control signal have a limitation which is commonly known as actuator saturation. There is also a structural constraint that limits the suspension deflection. In this study, an alternative approach to the vehicle active suspension system is proposed. In this approach, some separation in the controller such that one part is devoted to achieve nominal performance and the other part is devoted to constraint handling is performed. In addition, the actuator power consumption of the proposed control strategy is further investigated numerically. The simulation results show that the proposed control strategy can manage the trade-off between performance and the actuator power consumption.

**Keywords*:*** *Active suspension; Actuator saturation; Suspension deflection; Override control; Power consumption*

**Designing and Prototyping Surveillance Robot with Self-Protection using Nail Gun**

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**Abstract**― Designing and manufacturing / prototyping surveillance robot that has self-protection mechanism by using nail gun with VDI (Association of German Engineers) method, aims to design and create a robot that capable to conduct reconnaissance missions and protect themselves as well as immobilize the target object. The prototype robot is able to send data in the form of audio and visual through Wireless system by using Wi-Fi (Wireless Fidelity). The robot is equipped with self-protection system such as nail gun that can move in rotation and elevation, it is such an effective weapon to paralyze the targets objects if necessary. This robot is designed to maneuver on the field that has tilt angle up to 30º. Based on the test results, the robot is able to maneuver with speed 2.88 km/h on duration more than 30 minutes and be able to pass the field angle of 35º. Proximity sensors which are used as indicators of arm robots position works well on the pitch and yaw motion. Security system that is designed to shoot also works well. The most effective control radio frequency used is 2.4 GHz and the data sender system frequency is 5.8 GHz.

**Keywords*:*** *Prototyping; robot; surveillance; self protection*

**Hydrogen production from catalytic acetic acid steam reforming over bimetallic Ni- Co on La2O3 catalyst- Effect of catalyst dilution**

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**Abstract**― Catalytic steam reforming of acetic acid over bimetallic of 5 % (wt.) nickel-5% (wt.) cobalt supported on Lanthanum (III) oxide for hydrogen production were studied in a micro fixed bed reactor. The reactor was made from a quartz tube with 10 mm inside diameter. The present work is to study the effect of silicon carbide, as catalyst dilution on the reaction activity. The experiments were conducted at atmospheric pressure, 10 % wt. acetic acid aqueous, and in the temperature range of 500 to 700°C. The acetic acid conversion of the diluted catalyst reached almost complete with 550°C compared to 700°C for a non-diluted catalyst. The result shows that the presence of the catalyst dilution was indeed significant on the acetic acid conversion and the production of hydrogen, which could achieve higher conversion and high hydrogen production at a lower temperatures than with the catalyst dilution. The product gas distributions are not much different. It can be concluded that the presence of catalyst dilution is still significant for a micro reactor.

**Keywords*:*** *Hydrogen; Acetic Acid; Steam Reforming; Bimetallic; Nickel Cobalt; Lanthanum oxide*

**Effect of Cellulose Acetate Phthalate (CAP) on Characteristics and Morphology of**

**Polysulfone/Cellulose Acetate Phthalate (PSf/CAP) Blend Membranes**

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**Abstract**― Polysulfone (PSf) membrane is catogorized as hydrophobic membrane that easily fouled during membrane operation process. The presence of second hydrophilic polymer which added into membrane casting solutions plays a crucial role in adjusting the membrane properties. This hydrophilic polymer was employed in hydrophobic polymer membranes in order to improve hydrophilicity and performance as well as formed antifouling ultrafiltration (UF) membranes. In this study, a hydrophilic polymer, cellulose acetate phthalate (CAP) was added into polysulfone (PSf) membrane casting solutions by blending technique to produce PSf/CAP blend membranes. Flat sheet asymmetric PSf/CAP blend membranes were prepared by wet phase inversion method. The results revealed that an increase in CAP increased the hydrophilicity properties of PSf/CAP blend membranes compared to pure PSf membrane. The significant changes in size and numbers of microvoids and macrovoids in the morphological structures of PSf/CAP blend membranes were due to CAP promote the instantaneous liquid-liquid demixing during phase inversion process

**Keywords*:*** *Hydrophilicity; PSfCAP Membrane; Water Content; Contact Angle; Morphology*

**Trans-esterification of Triglycerides with Methanol on Sulfated Zirconia Prepared with different concentration of Sulfuric Acid**

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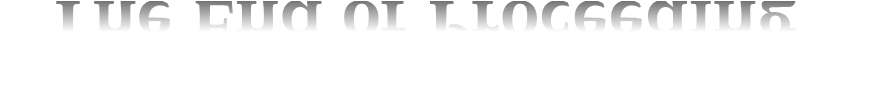
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**Abstract**― Biodiesel derived from vegetable oils is renewable and environmentally friendly than those of petroleum diesel. Currently most of the biodiesel is produced using homogeneous catalysts which are corrosive and non-reusable, leading to an increased cost and causing environmental problems. Alternatively, heterogeneous catalysts are being considered over homogeneous catalysts. Trans-esterification of triacetin with methanol was studied over sulfated zirconia which was prepared with different concentrations of sulfuric acid. Liquid-phase reaction was performed at 60oC for 8 hours using a stirred batch reactor. IR-pyridine was used to characterize the acid sites concentration and strength of the solid catalyst. Conversion of triacetin was about 69% on sulfated zirconia modified with 2M sulfuric acid. The conversion of triacetin was improved due to an increased in the amount of acid sites. The acidity of the sulfated zirconia has significantly affected the catalytic activity in the trans-esterification of triacetin.

**Keywords*:*** *Acidity; Biodiesel; Sulfated Zirconia; Trans-esterification; triacetin*



**The End of Proceeding**